SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS

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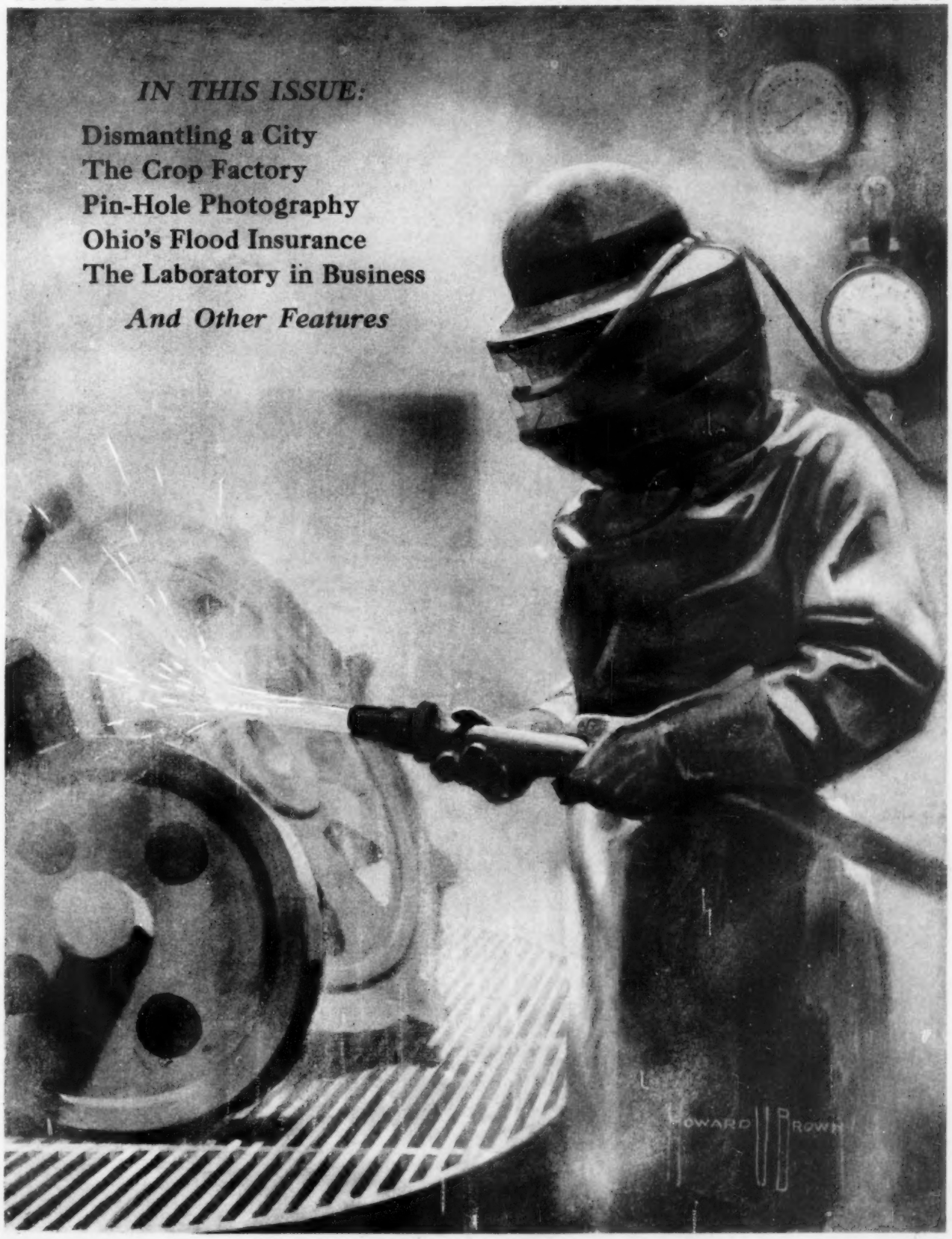


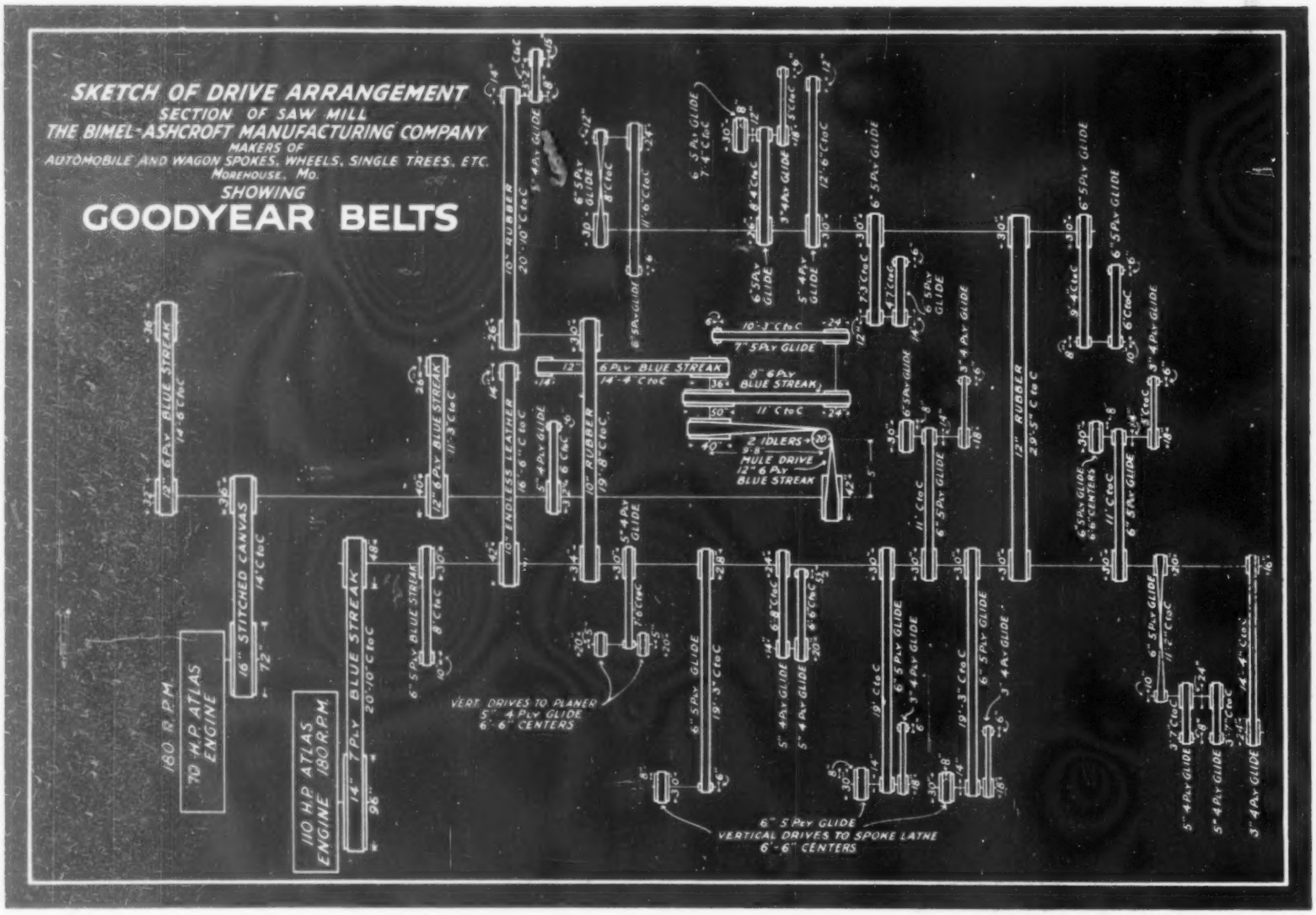
FINISHING OFF THE ROUGH CASTINGS IN THE SAND-BLAST ROOM

Vol. CXXII. No. 21
May 22, 1920

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

Price 15 Cents
$5.00 a year

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879



An Order, Two Plants—and the G. T. M.

The first time the G. T. M.—Goodyear Technical Man—talked with this Company that today has two plants practically standardized on Goodyear Belts he virtually declined an order. He had an opportunity to sell a belt of the same dimensions as the one which had just worn out after a short term of unsatisfactory service. Instead, he took the larger opportunity of demonstrating the value of an expert study of belting quality and working conditions.

The Bimel-Ashcroft Manufacturing Company had been having costly trouble with a 14-inch, 5-ply belt on the main drive in their Morehouse, Mo., plant. Time after time they had had to cut it because it stretched. Every cut meant a shut-down of the main drive, involving heavy loss of production. When, finally, the stretch was eliminated, the rawhide lacings began to break, the lacing holes pulled out, and the belt began to open at the plies. So they decided to get a new belt, and told the G. T. M. to send on one of his 14-inch, 5-ply belts.

"***Let me recommend*** a 14-inch, 7-ply Goodyear Blue Streak," said the G. T. M. "Your drive calls for a stronger belt than you have been using. Among the drive factors affecting the belt is a starting load 50% heavier than the running load." He went on to show how his analysis included every factor of power, pulley dimensions, and general service conditions. His recommendation finally was accepted on the strength of what he showed he had learned about that drive.

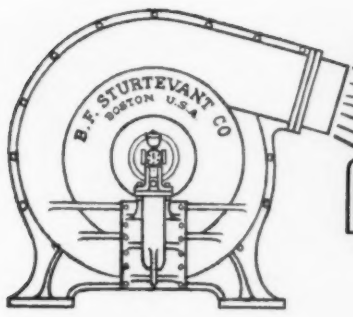
The Goodyear Blue Streak's success not only put an end to the main drive troubles but opened the way for analyses of the entire plants of the Bimel-Ashcroft Company at both Morehouse and Poplar Bluff. Today, two and a half years after the G. T. M.'s study of that one drive, 82 of the hundred belts in the Morehouse mill are Goodyear, and so are 50% of those in the plant at Poplar Bluff. As fast as any other kind of belt gives up a job, a Goodyear Belt, G. T. M.-specified to its work, takes its place.

In the racking service of the high-speed saws and lathes, Goodyear Glide Belts serve the tools; on the heavier drives of the bolting saws and the heading saws, Goodyear Blue Streak Belts withstand the severe duty with an inbuilt strength. These belts vary in length and width and plies and type of construction, but they are uniform in the quality that repays their slightly greater first cost with an ultimate operating economy. They deliver full power, hold the pulleys in a friction-surface grip, hold at the plies and wear both evenly and long.

The G. T. M. is at your service. If his recommendations prove valuable to you, our return will be increased, as it has been in this instance, by your satisfaction and the good word you will pass on to your fellow manufacturers. For further information about the G. T. M.'s method, and about the belts which Goodyear builds with the care implied in the command, "Protect our good name," write to The Goodyear Tire & Rubber Company, Akron, Ohio.

BELTING · PACKING · HOSE · VALVES

GOODYEAR



Sturtevant

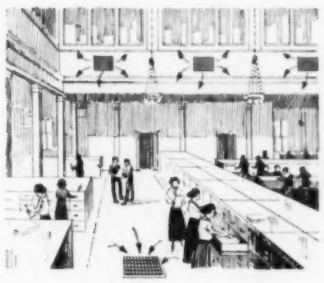
REG U.S. PAT OFF.

PUTS AIR TO WORK

WHEN a sudden gust of wind catches you and makes it difficult for you to walk, you get some idea of the strength in moving air. But when air acts kindly it dries drenched, impassable roads; turns windmills; supplies power to sailboats—performs a thousand services for man.

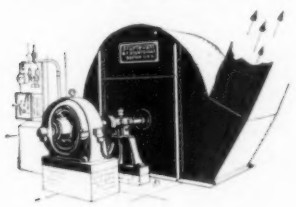
Sturtevant Apparatus makes the air act kindly every day; makes it hold just the right amount of heat and moisture; makes it blow hard or easy in any direction; makes it convey heavy bricks and light cotton—makes it do more kinds of work than most manufacturers realize.

Fresh Air Lowers the Sick List



The attendance records of a large insurance company showed that, in a room of eighty clerks, an average of eight remained away all the while. The office force was depleted ten per cent the entire year because of ill health.

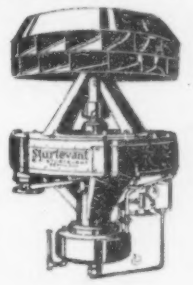
A Sturtevant Ventilating and Air Conditioning System was installed. Absence dropped to almost nothing. This particular ventilating equipment paid for itself in a very short time.



The benefits of good ventilation are even more noticeable in factories and in those industries where the manufacturing processes contaminate the air.

Consider the Destroyer

The destroyer of our era is propelled by coal or oil. But air is also used; sometimes to suck coal from the bunkers; sometimes to cool the wireless spark. Air apparatus keeps the engine room cool, and mechanical draft permits the fires to give greater heat and enables the destroyer to make 35 knots an hour. In the ship's kitchen and laundry, air equipment takes care of all excessive moisture, smoke, bad odors, and intense heat.



Many factories can take a lesson in efficiency from a Sturtevant-equipped destroyer, for there is hardly an industry in which air is not doing some work quicker and better than it was formerly done.

Sturtevant Service insures that every Sturtevant product be used in the place and way it should be used. Sixty years of experience are behind every Sturtevant product and every Sturtevant recommendation.

If you will write us the nature of your business, we will send you the bulletin which tells how air can be made to do your work. If you specially request, one of our representatives will visit you at your plant. Address

B. F. STURTEVANT COMPANY

EUGENE N. FOSS, President

Hyde Park, Boston, Mass.

or one of the following 24 Branch Offices in the United States and Canada

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Boston, Mass. . 555 John Hancock Bldg.
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Chicago, Ill. . 530 South Clinton Street
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Cleveland, Ohio . 330 Guardian Bldg.
Dallas, Texas . . . 3411 Knight Street
Detroit, Mich. . . 406 Marquette Bldg.
Hartford, Conn. . . 36 Pearl Street
Kansas City, Mo. . 412 Reliance Bldg.
Minneapolis, Minn., 804 Metrop. Life Bldg.
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Seattle, Wash. . . 1134 Henry Bldg.
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Galt, Ontario
Montreal, 404 New Birks Bldg.
Toronto, 210 Lumsden Bldg.

STURTEVANT ENGINEERING COMPANY, London

Secrets from a Waste-killer's note book

SUCH bits of salesmen's experience as are quoted below, are representative of the spirit of the Johns-Manville Sales Organization.

When Johns-Manville salesmen are assembled in conventions all over the land, these "close-ups" of personal experiences in everyday serving and selling come to light.

From note books, reports, or even from memory, come incidents which indicate more truly than anything else the kind of men they are and the type of institution they represent.

Each of these men in his territory is the Johns-Manville Company to a certain group of people. Collectively, these "waste-killers" are Johns-Manville Service—humanized.

So in presenting these little human experiences, we are hopeful that those who as yet may not know this company, through its men, may gain in part at least the regard for them that thousands with whom we do business, already have.

—from a convention talk by the Sales Manager.

Garage man says, "Our Brake-Lining is too good"

J. T. J. Garage says, "our lining lasts too long". A hard one to come back at, because the answer sounds like preaching. Told him that even though he sells less of our brake lining per customer, per year, he'll be building the kind of confidence that makes more customers. Either the advertising or the brake lining itself is making people ask for Johns-Manville instead of just brake lining—maybe both.

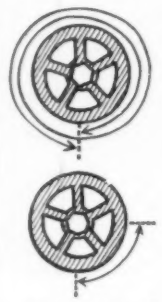
Confusion between Asphalt and Asbestos

Saw a man today who swore he bought Asbestos Shingles in flexible strips. He didn't have Asbestos Shingles at all. Very much disgusted when I showed him how much more durable and better looking and fire safe the Johns-Manville Asbestos Shingle would have been.

There's a lot of confusion between asphalt and asbestos shingles in the public mind. I notice our advertising is trying to straighten this out.

A piece of chalk that saved $5,000.00

Tuesday went through a plant where they had a lot of dryers and other equipment representing thousands of square feet of bare, hot surfaces. Drew a small square with chalk on one dryer wall and bet the engineer that one ton of coal a year was lost in wasted heat. Proved it with our tables—in fact, the figure should have been 1.6 tons. We start insulating all his dryers 2 weeks from today. He's glad I came in, he says.

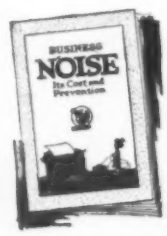


Here's a funny one

Saw two pumps exactly alike in engine room, Hotel ———

To start one, you had to open the steam valve two turns, then kick the rod before she'd move.

The other pump started easily with $\frac{1}{4}$ turn opening of the valve. Good idea to prove reduced packing friction when our Sea Rings are used instead of ordinary packing. Also less loss of steam power, saving in rod and packing wear.

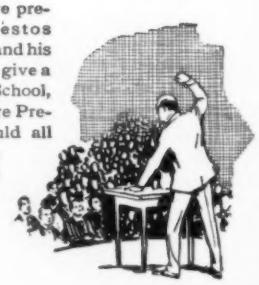


Sold 4,500 sq. ft. of silence

Stenographic room; 24 girls all working; some noise! Sold owner acoustical treatment by showing him saving from increased efficiency from his office force. Installation Contract has clause in it which says: Work to be done without serious interruption to business—easy!

Remember this date—

Give lecture on fire prevention. Our Asbestos Roofing distributor and his dealers asked me to give a talk at the High School, next Tuesday, on Fire Prevention. We should all do more of this, as a part of our service of conservation.



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296 Madison Avenue, New York City
10 Factories—Branches in 63 Large Cities
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Toronto

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

Through—
Asbestos
and its allied products

INSULATION
that keeps the heat where it belongs
CEMENTS
that make boiler walls leak-proof
ROOFINGS
that cut down fire risks
PACKINGS
that save power waste
LININGS
that make brakes safe
FIRE PREVENTION PRODUCTS

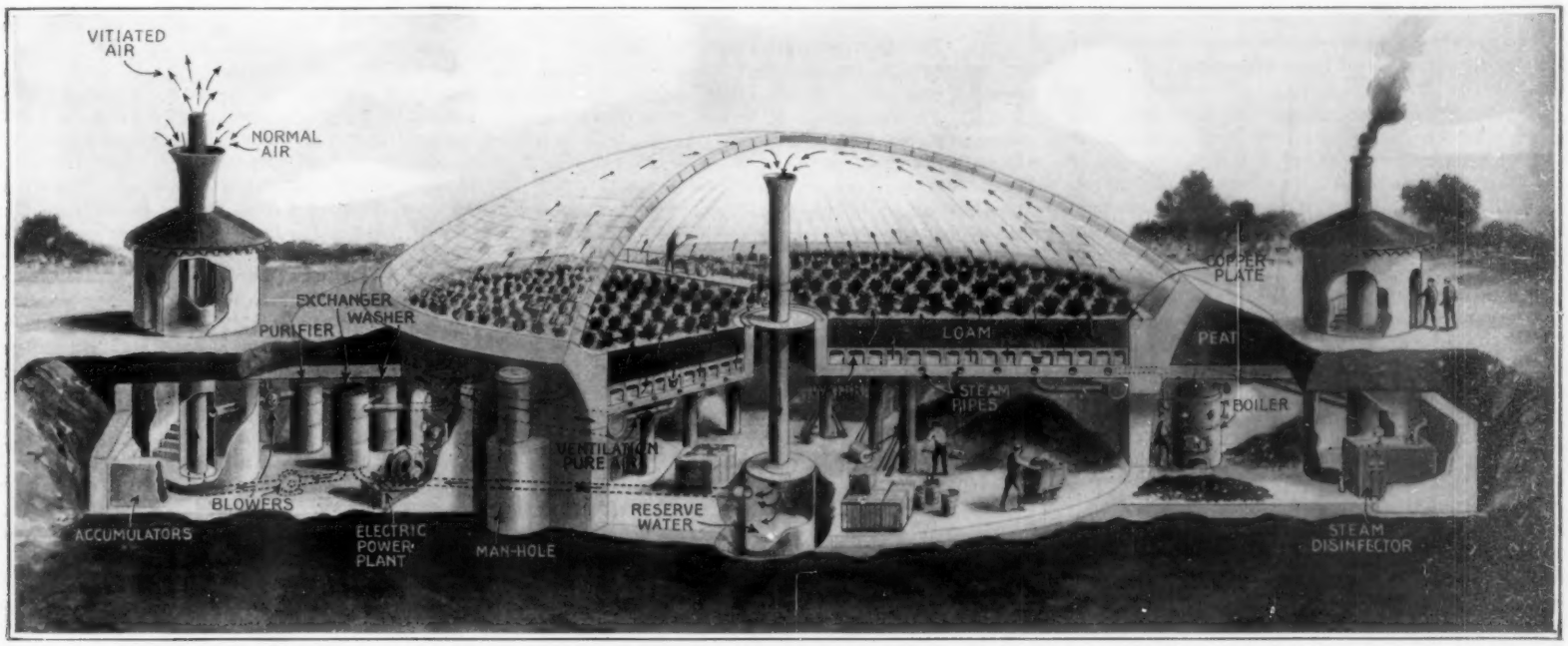
JOHNS-MANVILLE
Serves in Conservation

SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXII. NUMBER 21] NEW YORK, MAY 22, 1920 [15 CENTS A COPY $5.00 A YEAR



A proposed plant for gardening on a scientific basis and with complete independence of the usual elements. This scheme is based on practical gardening experience and experiments along these novel lines

The Crop Factory

Can Gardening Be Made a Standardized Industry, Independent of the Elements?

By Alexandre Livventaal

PRESENTLY the problem of the whole world is how to feed itself. The pressing need is the economical production of good food in plenty near the table of the human agglomerations, mostly distributed in the temperate and cold zones.

Next to cereals the staple diet is vegetables. They can be obtained galore at low costs by the intensive and systematic cultivation of the garden. Constant production can be depended upon if the climatic elements are well under the control of the gardener.

The soil has to be manufactured to suit the crop. Light, heat, moisture, and electricity are to be applied in wise manner to facilitate and stimulate the growth of plants.

It is a well-known fact that in the plains of northern Siberia, the sub-soil of which never thaws, a crop of rye is sown, matured and reaped within *forty-five days*. There the summer is short, but the sun shines almost throughout the day and night. Light and moisture are constant; should the heat be the same, Siberia would be a northern paradise.

In the tropics heat and moisture are plentiful, even over-plentiful; but sunshine is about one-half of its duration in the northern summer. Palm trees, oranges and tropical vegetation have thrived well in the imperial nurseries of Petrograd; splendid harvests of grapes are reaped in English and Belgian nurseries, yet it would be hard to pretend that palms, oranges and vines are indigenous plants of these countries.

On the islands of Jersey and Guernsey, as well as in the vicinity of European cities, yearly crops amounting to millions of tons of vegetables are grown under glass, fostered by the heat evolved by the fermentation of manure. Considering the primitive methods employed, the lack of labor-saving appliances and the overworked and poorly paid labor bearing the burden the results obtained are almost marvelous. Yet far more could be easily obtained if improvements had set in, but as long as cheap labor remained available and did not "kick," the nurseryman burdened by taxes and competition, and to a certain extent lacking in engineering knowledge and inventiveness, could not face experimenting nor the costs involved therein. Engineering knowledge and technical resourcefulness, for the same reasons, discarded nursery-work.

Such were the conditions when the writer took a position in the matter. His first step was to acquire practical knowledge of gardening and nursery work, and with this end in view, he spent two years of hard work, almost hard labor, to be sure, as a common laborer in the nurseries of England and France, and three years in his experimental garden in Switzerland. The careful observations made, coupled with the practical experience acquired during this time and since, enables him to present to the reader a few facts and some labor-saving devices that may prove helpful and induce others to work for further improvements and researches beneficial to the community at large.

The earth, like human beings, breathes; it inhales air during high barometric pressures and exhales it during the periods of atmospheric depression. Wind and variations of temperature add to these effects. Independently of other factors, the better the ventilation of the soil, the better the growth of plants. This fact has been practically demonstrated in America. Trees planted on soil that had been disintegrated by explosives grew faster, bigger and bore better and more fruits than trees planted on non-exploded ground though better manured.

The writer paid a great deal of attention to this matter and in evolving his labor-saving garden, took into consideration that light, heat, moisture, ventilation and electricity, which are the climatic conditions of his self-made Eden, are to be under absolute control if results are to be obtained. But in thus helping natural growth by eliminating adverse climatic conditions, he had to draw the line between useful and parasitic growth, thus dividing his efforts to facilitate the former and stamp out the latter.

Weeds and undesirable plants have a spectacular propensity to grow where they have no business to. Dry rot, fungi, and even parasitic growths will invite themselves to the feast; all sorts of microbes and animal vermin will pounce upon the place and make it their abode. Anyone connected with agriculture knows that there is more work and time to be spent fighting to preserve the crop than to grow it.

A great amount of seeds of undesirable character, of cryptogram and fungi spores, of microbes and vermin are either flying through or floating in the air. Others will be found in the loam and develop there under favorable circumstances. The only method to fight them with success is first to manufacture the loam and disinfect it, and then isolate the garden from the ambient pest-loaded atmosphere. Scientific ventilation will do the rest.

After years of severe fighting with droughts, hail, late frosts and blizzards, excess of rain, lack of sunshine, bad seeds, May bugs, white, wire and other worms, butterflies and caterpillars, fungi and cryptograms, predatory birds, wild cats, dogs, rabbits and marauders in general, the writer modified completely the lines of his garden and finally reconstructed it as illustrated. Geometric forms were resorted to as they give the greatest area for the shortest walls and the smallest exposed surfaces.

The nursery is well sunk in the ground to avoid losses of heat by radiation, and a cushion of peat is carefully dammed around it. The glass surface is built up of the well-known Swiss hollow brick and needs no other frame than the concrete base. The total

(Continued on page 582)

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, May 22, 1920
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Steam Locomotives and the Coal Bill

THAT we are eating up our fuel supplies at an accelerating rate and that their exhaustion, if not an immediate threat, must take place within a calculable period, is a fact which, alas, is becoming so commonplace that we are in danger of missing its portentous significance. In this connection, we call attention to an article in the current issue of the SCIENTIFIC AMERICAN MONTHLY, entitled "The Last Stand of the Reciprocating Engine," which gives some startling figures as to the great coal consumption of the locomotives of our railroad system, and demonstrates how great a saving could be effected by the substitution of electric for steam traction.

Under the caption "Railway Fuel in 1918" is a table which shows that of the total coal production in the United States of all grades of 678,000,000 tons, the steam railways used 163,000,000 tons, or 24 per cent; and that of the total oil output in the United States, the steam railways used 5.8 per cent. Adding the coal equivalent of this oil to the coal consumption, we find that the total equivalent used by steam locomotives reached the huge figure of 176,000,000 tons. If we add the standby losses incurred in the roundhouse, in cleaning fires, coasting down grade, et cetera, it is found that there is a value of 10.27 pounds of coal consumed per horse-power-hour at the rims of the driving wheels. The equivalent coal per kilowatt-hour at the driver rims would be 13.75 pounds, and the coal per kilowatt-hour at the power supply, on the basis of 55 per cent efficiency, would be 7.56 pounds. As the writer says, it is this 7.56 pounds of coal, burned on steam engines, to get the equivalent tonnage movement of one kilowatt-hour delivered from an electric power station, that is of special interest.

In arriving at his estimate of the coal saving, which would be effected by substitution of electric traction for steam traction on the whole United States railroad system, the writer takes the data of actual operation of the Chicago, Milwaukee and Saint Paul Railway on its electrified Rocky Mountain Division, which gives a figure of 33.2 watt-hours per ton-mile for the combined passenger and freight movement. Applying this to the total ton-mile movement of all railways in the United States in 1918, he arrives at a kilowatt-hour total movement of 48,700,000,000 which, at seven pounds per kilowatt-hour, gives a coal requirement of 170,000,000 tons. This agrees quite closely with the 176,000,000 tons estimate of actual equivalent coal consumed on steam railroads for 1918, and the values check up so closely as to justify the startling conclusion that 122,500,000 tons of coal, or more than two-thirds the coal now burned in our 63,000 steam engines would have been saved during the year 1918 had the railways of the United States been completely electrified along lines which today have been fully tried out and proved to be successful. This vast amount of coal is fifty per cent greater than the pre-war exports of England and twice the total amount consumed in France for all its railways and industries. Nor are these estimates of saving excessive; they make no allowance for the extensive future utilization of water power which will tend to reduce the consumption in railway power stations.

These startling figures are based upon actual results obtained under electric operation through the Rocky Mountains. They are not guesswork. For the same freight tonnage handled over this electrified division, electric operation has effected a reduction of 22½ per cent in the number of trains and 24½ per cent in the average time per train, and has so greatly improved the operating conditions that nearly thirty per cent more tonnage can be handled in about eighty per cent of the time it formerly took to handle the lesser tonnage by steam engines. Finally, the writer tells us (and it is difficult to find any gap in his line of close reasoning based on established facts) that we are today wasting enough fuel on our steam engines to pay interest charges on the cost of completely electrifying all the railways in the United States—fuel, mark you, which Europe stands in sad need of and which England and Germany, the pre-war coal-exporting countries, cannot now supply.

The Disreputable Conservative

HISTORY records what happened to Galileo when he suggested that current scientific doctrine ought to be revised. The Copernican system replaced that of Aristotle and Ptolemy only after a bitter stand by the advocates of the old order. Early ideas as to the nature of fossils and how they came to occupy their places gave way with reluctance to a rational explanation. Oxygen threw phlogiston out of court only after a long and acrimonious controversy. And so it has been in every field of science. To those whose eyes are always turned impatiently forward, science seems to move with lagging feet and face averted from her goal; the bulk of her devotees will usually be found prepared to support what is old and tried against what is new and unfamiliar.

Without any intent to inquire to what extent this conservative attitude of the typical scientist is proper, we may point out one curious result thereof. How the thing works may perhaps be best illustrated by a concrete illustration.

John Jones is possessed of a speculative mind, and gets to thinking about some topic of fundamental scientific importance. He realizes, perhaps, that most of the "proofs" of the earth's sphericity that are in common circulation are proofs, not at all of sphericity, but merely of curvature. He conducts what he is pleased to think of as an independent and thorough investigation of the facts, and concludes that as a matter of reality the earth is not a sphere, but is shaped like a shallow wash-basin, or a conventionalized pineapple, or a cake of soap, or any other curved surface that may occur to him as capable of circumnavigation in one direction but not in another. Or perhaps his particular form of disbelief takes a mathematical turn, and he insists that the only reason why nobody has ever squared the circle is because nobody ever went about it in the right way.

Of course such a proposition ought to be met on its merits. We cannot spare time to demonstrate individually to the two billion inhabitants of the world each and every fundamental fact of the universe, it is true. But, on the other hand, we cannot expect that Mr. John Jones is going to subside when we tell him the earth is a sphere because everybody knows it is a sphere, or that *pi* is transcendental because the mathematicians are agreed that it is so. Within the limits of sanity we ought to be prepared to meet Mr. Jones with facts that controvert his arguments—just as he must be prepared with facts which he thinks support them.

At any event, Mr. Jones will insist that we do this, whether we are willing to do it or not. He is very clear that mere consensus of opinion against him is no argument at all. But—here comes in the phenomenon which we are trying to exhibit: while he is quite convinced that consensus of opinion against him is *per se*, no argument against him, he is equally certain that it is, *per se*, an argument for him.

His reasoning runs something like this: Galileo and Columbus and Copernicus and scores of pioneers in other branches of science were ridiculed, ignored, summarily dismissed without consideration. Here am I, with the same thing happening to me; all I can get from the scientific world is scorn, ignorement, summary dismissal. Therefore, my theory is on the same basis of inherent soundness as the theories of all the scientific pioneers; I am right and some day the world will recognize me for the genius that I am, will couple my name with that of Darwin and of Lyell and others of their ilk.

When some disreputable political organization gives its support to a candidate, it is frequently remarked that such support is as much of a liability as it is an asset. By its support the machine is apt to weaken the thing it supports. Of course the case of which we speak is not so extreme, because the fallacious reasoner whose arguments we have outlined merely thinks the cause of established science is weakened by the adherence of competent scientists. But the phenomenon is none the less curious as a sample of fallacious reasoning; and doubtless all of our readers will recall instances where they have met it.

The Serious Traffic Situation at New York

ADDITIONAL light has been thrown upon the traffic situation in this city by a recent statement of A. H. Smith, president of the New York Central Railroad and one of the Regional Directors under the Railroad Administration of Mr. McAdoo. He tells us that the railroads of the United States are short 100,000 freight cars, 4,000 passenger cars and 2,000 locomotives, and that it would cost at present prices seven hundred million dollars to purchase this equipment. As regards the present high prices of food in New York, he finds the cause not merely in inadequate railway facilities, but in the lack of warehouses in New York itself. Thus, he tells us that it costs more to handle a barrel of flour in the city of New York in its first handling by motor truck than it does to bring it from Chicago to New York. Taking as an example the Harlem District, which has a population of about one million, he states that it has the railroad facilities of a town of ten thousand. As the result of this condition freight is hauled by rail through Harlem and ten or twelve miles down Manhattan at a cost of one cent per ton per mile, and is then hauled back to the Harlem District by motor trucks at a cost of about fifty cents per ton per mile.

This is merely one local instance of what a shortage of facilities does in raising the cost of foodstuffs. He quotes the estimate that two hundred million dollars a day is wasted in this city because of our extravagant methods of distribution, and it should be remembered that every person living on Manhattan Island pays his share to meet this altogether unnecessary expense. He reminds us that during five days of the recent strike, with its crippling effect upon harbor movements and switching, the West Side tracks were called the "life line of New York," and we are told that in five days this system unloaded 1,640 carloads of food, which is equivalent to about one pound a day for every man, woman and child in the city. The remedy, or rather an important one among the many remedies for this situation, is the construction of suitable storehouses down the west side of the Island. If this were done, it would be possible to maintain an adequate reserve upon the Island itself. Trucking in the streets would be relieved, since it would be then necessary to move only what was required for the city's immediate use, and all freight for reshipment would move directly from warehouses into cars.

The construction of warehouses adjoining or opposite the West Side piers is part of the general scheme for placing our railroads in immediate touch with the whole water front of the port of New York. This scheme contemplates the tunneling and bridging of the Hudson River and the construction of a double deck elevated road from Fifty-ninth Street to the Battery, with switches and turn-outs which would allow cars to be run out onto the piers of the Hudson River or directly into the warehouses on West Street. This improvement in Manhattan and the construction of a belt line intercepting the various railroad systems and connecting them with the whole water front from Staten Island to Brooklyn is an improvement which will have to be made if New York is to maintain its position as the leading port of the Western Hemisphere. It is a vast scheme and will call for much discussion and planning before active construction can be begun. The preliminary steps should be undertaken at once.

Electricity

Electricity's Contribution to French Reconstruction.—It is reported that production in France is now greater than before the war, this being partly due to the great extension of electric power service. Before the war, France had 700,000 horse-power in service electrically compared with 1,500,000 horse-power now, and it is expected that in five years this total will be increased to 5,000,000 horse-power.

Dressing the Commutator.—There are several excellent commutator dressings available today for ensuring the proper commutation of any generator or motor. One of the most successful of these devices is an abrasive block which is held against commutators or slip rings while the machine is in motion or under full load. It is claimed that ridges, high mica and flat spots are quickly leveled down, and sparking or loss of power eliminated.

Radio Receivers of the Italian Navy.—From a German source it is learned that the adoption of undamped-wave transmitters in the Italian Navy led to a study of receivers capable of receiving both spark and undamped-wave signals. The type of receiver adopted was the so-called "ultraudion" receiver in which a single valve acts at the same time as oscillation generator and as detector. Three types of apparatus, according to the requirements of shore and ship stations, were built, the wave lengths ranging from 300 to 15,000 meters.

Hardening and Softening of Vacuum Tubes.—A recent issue of the *Radio Review* contains an interesting discussion of what happens to the gas in the so-called vacuum tube when it disappears. Dr. Eccles, the well-known radio authority, holds that the gas goes into the filament. It is pointed out that to do this the gas which may in certain circumstances be absorbed in a valve would occupy when fully condensed a volume equal to one-fifteenth of the filament itself and it is improbable that so much gas could be taken up by a solid heated to incandescence. On the other hand, if the gas were absorbed by the walls of the glass tube, the amount of gas so removed would form a layer only about one molecule thick if evenly spread over the glass. The existence and stability of such layers have long been recognized.

Enclosed Electric Motors.—The Electric Power Club proposes that motors having brushes or sliding contacts exposed to combustible dust should be placed in a flashproof or semi-flashproof room or enclosure of approved construction. This would make it unnecessary to charge higher premiums for the insurance of motors so situated. The room should be as dust-proof as possible and large enough to make the motor accessible; it should be provided with ventilation to clean outside air. A wooden framework lined with metal lath and cement plaster or ¼-inch hard asbestos board, with door metal clad and provided with wire glass window and cement-covered floor is considered to be the most practical form of room, the *Electrical Review* goes on to say. Motors mounted on ceilings may be enclosed by lighter enclosures of asbestos board. These suggestions have been put forward for inclusion in the National Electric Code.

Increasing Capacity of Transmission Lines.—In a recent issue of *Electrical Review* an author shows how the need for increased capacity of distribution lines and network brought about by a rapid growth of the central-station power load can best be met under different conditions. In general, power distribution systems are carrying, at the original voltage for which they were designed, much greater loads than they were originally designed for. Their capacity can be best increased by increasing the voltage from the point of view both of the cost and of the quality of service as measured by voltage regulation. If the existing voltage is 2,300, an increase to 4,000 can generally be made very readily and in almost every case will be found desirable. This means that an increase in capacity of 73 per cent can be obtained with little or no new equipment and at a very low cost. In some cases a greater increase in voltage will be desirable, in which case the reinsulation of lines and new transformers will be required.

Science

Grants to Repair War Damages.—The Paris Academy of Sciences has made, from the Loutreuil foundations, a grant of 6,000 francs to the Société Géologique du Nord, to enable it to resume work interrupted by the war; a grant of 10,000 francs to the Ecole des Hautes Etudes Industrielles et Commerciales, of Lille, for restoring the material of its chemical laboratory; and a grant of 20,000 francs to the Observatory of Ksara (near Beyrout) toward restoring that institution, which was practically destroyed during the war.

An Internal Hydrographic Bureau.—From an account published in *Nature* of the proceedings of the International Hydrographic Conference, which met in London last July, it appears that one of the most interesting developments of the meeting was the discussion of plans for an "International Hydrographic Bureau." There was unanimous agreement as to the need of such a bureau, which should be a purely advisory body with no executive powers, charged with the task of promoting coöperation between the various national hydrographic offices, continuing the deliberations of the recent conference on several unsettled questions, and, in general, watching over the development of the science of hydrography. The conference appointed a committee consisting of Admiral Parry (then hydrographer of the British Navy), M. Renaud, the French hydrographer, and Rear-Admiral Simpson, hydrographer of the U. S. Navy, to take up with the various governments the question of establishing the proposed bureau, and to proceed with the task of organizing it if the project is approved.

The International Catalogue of Scientific Literature.—An account of the present state of this enterprise appears in the current annual report of the Smithsonian Institution. The receipts of the London central bureau, whose sole support is derived from sales of the catalogue to the various subscribers throughout the world, have been greatly curtailed, and unless subscriptions increase or the bureaus of Germany, Austria, Hungary, Poland, Belgium and Russia, which are in arrears to the extent of almost $9,000 per annum, again contribute their support, it will be necessary to obtain financial assistance from some other source, after the publication of the fourteenth annual issue. The Royal Society of London, which has been the principal sponsor of the catalogue from the beginning, has recently announced that some new financial arrangement will be necessary hereafter, and has requested the academies of science throughout the world to offer suggestions as to the best way of financing the undertaking. From another source we learn that the Councilium Bibliographicum, of Zürich, is contemplating a material enlargement in the scope of its publications, which may eventually make the International Catalogue, as now constituted, a superfluous enterprise.

Solar Radiation in the United States.—Attention has often been called to the fact that, although abundant statistics are available concerning the normal distribution of air temperature over most parts of the earth, there are but meager statistics of the distribution of the radiant energy received from the sun. These two kinds of data are by no means parallel, and they are sometimes strongly contrasted. On mountain summits, for example, the air temperature is generally low and the intensity of solar radiation high. Moreover, solar radiation, on account of its influence on animal and vegetable life, is a climatic element of great importance. Another neglected element of climate is illumination from the sun and sky. We have rather extensive data of the duration of sunshine in many regions, as registered by automatic sunshine-recorders, but these take no account of the intensity of the light. In view of these facts, special interest attaches to a recent paper by Prof. H. H. Kimball in the *Monthly Weather Review* on "Variations in the Total and Luminous Solar Radiation with Geographical Position in the United States." The data presented under these heads, in tables, charts and diagrams, are based upon actual measurements at four places, viz., Washington, D. C., Madison, Wis., Lincoln, Neb., and Santa Fe, N. M., together with certain incidental data obtained elsewhere, and represent in a general way conditions prevailing over extensive areas of the country.

Aeronautics

The Gordon-Bennett Cup.—The French Aero Club has decided to make the contest for the Gordon-Bennett Aviation Cup an occasion of considerable importance, the Cup contest forming the principal event of a sort of flying week such as were prevalent in the early days of aviation. Plans for a number of competitions have been approved by the Aero Club, and it is anticipated that the entries will be numerous. The meeting will take place outside Paris from Monday, September 27th, to Saturday, October 2nd, 1920.

Navy Dirigibles World's Largest.—Two superdirigibles, the largest in the world, are planned by the Navy, and one of them now being built in England, will attempt a transatlantic flight next fall, Captain Craven, director of naval aviation, recently told the House Naval Committee. American naval officers and enlisted men who will fly the British-built ship to America are in England training. In asking $2,700,000 for construction of a second superdirigible, Captain Craven said it would be fifty feet longer than the British-built craft, which is 644 feet.

Fokker's Latest Creation.—In a recent issue of *Aeronautical Engineering* there appears an illustration of one of the latest products of the Dutch Fokker concern—a six-passenger monoplane limousine. The most striking feature of this machine is the very large span and the high loading combined with a cantilever wing construction. Taking into account the fact that the load per horse-power is nearly 23 pounds, the performance claimed—a speed of 93 miles per hour and a climb of 13,120 feet in 45 minutes—indicates that the bizarre placing of the monoplane surface well above the body is by no means as inefficient as is generally supposed.

An Electrical Turn Indicator.—There has recently been introduced in German flying circles an instrument that indicates the difference in air speed between the two wing tips, which is but another way of expressing the rapidity of turns. Two venturi tubes are used, one over each wing tip. Each venturi contains three resistance thermometers, one in the throat, one in the entrance section, and one in the exit section. The temperature difference between the throat and the entrance and exit can thus be obtained for each venturi. By combining two instruments differentially, the difference in temperature between the two throats can be measured. This temperature difference will depend on the rate of turning. It is claimed that the electrical recorder has very little lag.

Baboons and an Airplane.—Writing of the passing of an Avro biplane over Uitenhage en route to Port Elizabeth, a South African newspaper has the following to say: "Mr. Norman Chase relates a peculiar experience he had in connection with the 'plane. He was bathing at Kamaehs, when he noticed a number of baboons which were in the vicinity showing unmistakable signs of fear. They crowded together and whimpered, giving every indication that something unusual had disturbed them. Mr. Chase's dog, a well-bred Airedale, and known to be plucky and fearless, also became uneasy, and appeared to be in dread of something. On looking round for the cause of all the trouble, Mr. Chase observed the airplane flying overhead at a comparatively low altitude. The sound of the engine and the huge birdlike appearance of the 'plane no doubt upset the equilibrium of the baboons."

The Study of Air and Aerofoils.—The National Advisory Committee for Aeronautics has recently issued its Report No. 28, which is an introduction to the study of the laws of air resistance of aerofoils. This report has been written for the purpose of giving a general survey of the present state of knowledge about the laws of air resistance of aerofoils. After a summary of the history of the subject and of the bases of the present-day treatment of the phenomena of fluid resistance, given in the introduction, the report starts by a critical discussion of the fundamental concepts used to describe the fluid resistance properties of aerofoils. Thus are successively examined the concepts of angle of attack, center of pressure, aerofoil area, metacenter, metacentric curve, zero lift line and resultant air resistance. A copy of the report may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Dismantling a City

How a Great Army Camp Is Converted into Second-Hand Building Material

By Harry A. Mount

RELIEF, in some small measure at least, from the present nation-wide housing shortage is promised in the wrecking of a score or more of our great military cantonments within the near future. One of these, Camp Doniphan, Lawton, Oklahoma, has already been completely wrecked and six others are now being torn down.

But the disposal of the larger part of the scores of camps established during the war awaits congressional action and it is in these that hope of real relief lies. An idea of the enormity of the task involved, the great quantity of building material released and of the possibilities offered to civic and other organized bodies seeking housing facilities, can be gained from taking stock of what already has been accomplished.

The six camps which are now being wrecked are Camp Shelby, Hattiesburg, Miss.; Camp Mills, Long Island; Camp Stewart, Newport News, Va.; Pelham Bay Naval Training Station, Pelham Bay, N. Y.; Camp Oglethorpe, Chattanooga, Tenn.; and Camp Merritt, Tenafly, N. J. Camp Merritt is the largest of these. It was the great embarkation camp for the port of New York and because of its proximity to New York, where the housing situation is probably at its worst, the wrecking of the camp has brought forth some unusual incidents.

In many cases small buildings have been sold as they stand and moved, whole or in parts, to nearby towns where they have been remodeled into small homes. Many of the small buildings have been carted away for use as garages or additions to dwellings and some of the long barrack buildings have been sold intact for use as factory buildings.

The demand for lumber has been found so great that no attempt is made to store the salvaged material. It is simply systematically sorted on the spot where the building stood and is sold and then carried away by the purchasers as fast as the buildings can be wrecked.

During the early spring months when bad weather hindered operations, the demand for the salvaged lumber far exceeded the supply. On several occasions men of moderate means, who found themselves without homes and no relief in sight, literally begged that they be sold enough lumber to build "some sort of a house before the first of the month."

In the case of this camp, as with most of the others so far disposed of, it was sold outright to a house-wrecking company by the war department. "House-wrecking company" is, however, a misnomer, because very little "wrecking" is actually done. Practically every bit of material used in constructing the camp is salvaged and resold for use again. The only "wreckage" worthy of the name is the small ends of boards which are sold as kindling.

This camp alone will produce 30,000,000 board feet of usable lumber, according to the wrecking company's estimate. In addition there are such "by-products" as 100,000 sash, 20,000 doors, 5,000 toilet outfits, 1,000 tons of iron pipe, 24 tons of electric wiring, 1,500 hot air furnaces, and scores of lesser items.

It is estimated that if a man purchases a building as it stands and wrecks it at his own expense, the salvaged lumber will cost him a little over $35 a thousand feet, whereas the cheapest pine lumber he could get at a lumber yard would cost about $75 a thousand feet. Furthermore, he secures siding, flooring, and other lumber which would be much more expensive. He can make an even greater saving by using this lumber to erect a house proportioned so that the same lengths of lumber in the original building can be utilized. Thus, if 25-foot beams and rafters were used in the camp building, he would have to erect a house using this same length. In doing so he would avoid "piecing" or cutting the lumber to length and effect a saving in labor and material. If the new house is built so that it will require about the same surface in walls, floors, etc., the purchaser will find he has about the right proportion of each kind of lumber needed.

This fact has been taken advantage of by the purchasers of the long barrack buildings, who intend to use them for factory buildings. In every case the building has been entirely wrecked and rebuilt in about the same form, from the salvaged material.

The business of "wrecking" a camp as carried out by the big wrecking companies now at work is in accordance with perfect system. Small sections of the camp are wrecked at a time. The first building to be wrecked is entered by a gang of plumbers who carefully remove all plumbing fixtures. This gang then proceeds to the next building and they are followed by a gang of electricians, who salvage all of the electric wiring and fixtures. Each class of material is stored in a separate warehouse. Then come the wreckers who first "gut" the building, leaving only the bare walls standing. The walls are then pulled over and the wrecking completed. The final gang is composed of boys and old men who pull the nails, sort the lumber, stack it and pile all refuse and kindling ready to be carted away.

An office force is kept busy in one of the buildings listing the salvaged material. Even parts of stoves and furnaces are saved and these are card-indexed. Many such parts are found in the razing of a large camp and by reference to the card-index files it is usually possible to find "mates" to those parts.

It is impossible, however, to salvage the sewage systems, the miles of paved streets, and water mains that are a part of the equipment of these camps and which represent an enormous investment. It has been

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1. One of the several community houses which have fallen victim to the axe, hammer and saw of the house-wreckers. 2. Typical street in Camp Merritt, showing the large sleeping barracks and the small houses before the house-wreckers get to work. 3. One of the many piles of building material, in this case complete window frames, ready for use. 4. A row of sleeping barracks after the house-wreckers have got through the preliminary work of clearing the interior. 5. The main thoroughfare at Camp Merritt—a splendid concrete road which runs throughout the length of the community.

A collection of views of Camp Merritt, near Tenafly, N. J., which is now being dismantled by private contractors in order to clear the ground

Three views of a building in which the steel work has been welded together. Note the peak of trusses and an end of a truss, together with the convincing load test

The Welded Joint in Structural-Steel Work

By Ralph Howard

THE interesting thing about electric arc welding is not so much the method which is employed, but rather the constantly widening application of it as an industrial process.

One of the noteworthy achievements has been the recent demonstration of its practical application to steel construction work.

An electric welding company needed a new building as an addition to its plant in Brooklyn, and needed the building in a hurry. The engineers were absolutely confident that such a building could be constructed by welding instead of riveting, and that there were specific advantages which would result from such a method of construction.

In the first place, the construction work could be done during twenty-four hours of the day without disturbing the people in either commercial or private life, because the process is absolutely silent, the nerve-racking noise of riveting being entirely eliminatel. Second, the necessity for fabricating steel parts was almost entirely eliminated, and likewise the necessity of waiting several weeks until such parts should be fabricated and made ready for erection. Third, by electric welding, joints of 100 per cent strength were made possible, as against the ordinary sixty or seventy per cent strength possessed by a riveted joint. Fourth, there was possible reduction in the actual weight of metal required in the various members. Fifth, tests indicated that construction work by electric arc welding could be done at lower cost than by riveting.

Before the company could proceed with its building plans, it was necessary to obtain permission from the various city building departments, and such permission would only be given if certain tests were made which would satisfy the building officials that a welded structure would be absolutely safe and would compare favorably in all other respects with a riveted steel framework. Certain samples of welded joints were required for tests as to strain, compression and shearing.

The tests of these samples were entirely satisfactory to the building officials. Permission was subsequently given to proceed with the erection of the steel framework, but there was still another test to be made of the steel trusses of forty-foot span, which were to be used to sustain the roof. These trusses were of fan type of design and all members were electrically welded together, no bolts or rivets being used. The trusses were spaced twenty feet apart, supported by 8 x 8 H-beam columns 19 feet high; on the sides of these columns, brackets were fastened to carry an overhead traveling crane of five-ton capacity. The weight of each truss was about 1,400 pounds. The top and bottom chords were composed of 4 x 5 x ⅜ T-irons, and the struts were 3 x 2 x ⅜-inch angles.

The trusses were designed for a live load of 40 pounds per square foot, each truss supporting a panel of 800 square feet. They were tested at a load of 120 pounds to the square foot, or a total load of 48

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Where coal is mined in the open air after stripping off the over-burden

Open-Air Mining of Coal by Electric Shovels

By G. Orb

LOCATED near the town of Straitsville, Ohio, at a little place called Baird Furnace, is a stripping coal mine which has many unusual features. One of the things about this plant is that the shovels are driven by electric power, digging coal and shipping it some fifty miles to a large central power station where it is converted into power for transmission through high tension lines to the works. Here it operates the electric shovels for stripping the shale and slate from the coal, also for digging and loading coal, pumping water from the pits, running the shops where the machinery is getting repaired, and running the coal cleaning and grading machinery used in sizing it for the market. In fact the only steam used around this plant is for the locomotives.

One of our photographs shows a small shovel which is used for digging and loading coal into the five-ton dump cars. In the rear of the shovel is seen a locomotive connected to a train of cars, and beyond the locomotive appears the most interesting machine of all—the stripping shovel which digs the overburden from the coal, and deposits it in the waste bank in the place from where the small shovel has loaded out coal. After they get to the end of the cut, the two shovels will go in the other direction and repeat what they are now doing. First the little shovel will load out the coal so as to make room for the big shovel to deposit the waste or overburden. These successive cuts are about 30 to 35 feet wide, one repeating the other.

The coal-loading machine derives its power from a 50-horse-power motor. The size of the bucket is 2 cubic yards, which is about 1½ tons of coal. The large stripping machine has a 6-cubic-yard dipper, and the digging is done with a 340-horse-power motor. The boom is 90 feet long and the dipper handle 56 feet. The machine weighs 350 tons in working condition, while the smaller one weighs 50 tons. Another photograph shows a closer view of the coal-loading shovel. It is

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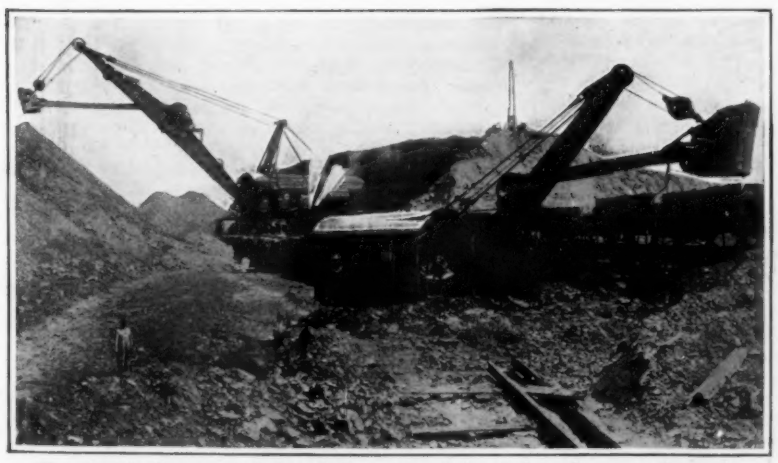


The electrically-operated shovels that strip off the shale and remove the coal

A closer view of the caterpillar-mounted stripping shovel

The International Trademark

Steps Toward Easier Protection of American Rights in Foreign Countries

By Chauncey P. Carter

THE trade-mark registration laws of practically all countries may be divided into three general classes. First there are those laws which provide for the registration of any mark properly applied for, such registration constituting merely a claim to ownership of the mark registered. Second are those laws which provide for the registration of marks only after examination has been made to determine whether or not they are available for exclusive use by one manufacturer, by reason of their inherent qualities and prior established rights, and which registration constitutes merely evidence of title. Finally, there are those laws which *grant* ownership of a trade-mark by means of registration after examination of the same nature as in the second class.

Up to the present time, the United States has been operating under a law of the second class. While the law of February 20, 1905, as amended to date does not state definitely what is a trade-mark, it does so by inference and also by definite statement as to what may *not* be registered as a trade-mark. To be sure a mark to be registered under it must undergo the strictest kind of an examination to determine whether it is geographical, descriptive, a proper name not distinctively shown or already registered or known to be in use by another (possession of any one of these or of certain other qualities being a ground for refusal). Nevertheless, the registration that may be obtained after this careful examination, which often delays registration more than a year, is merely *prima facie* evidence of the registrant's title to the mark and little better than the claim to ownership effected by a registration under laws of the first class.

It will be seen, therefore, that there is little or no difference in the principles governing trade-mark registration laws of these two classes. The distinction is wholly practical and resides in the delegation to an executive body such as our Patent Office of a certain amount of judicial discretion subject to review. As a result of this, it has been a fairly simple matter for a nation with a law of the first class to arrange reciprocity by means of convention or treaty with one or more countries having laws of the second class. It has not been quite so simple, however, to make mutually satisfactory arrangements between a nation having trade-mark laws in one of these classes and a nation having laws of the third class. The reason for this is that the difference is no longer merely a practical one; it is one of fundamental principle, the law in the one case being based on the theory of acquisition of ownership by virtue of earliest adoption and use, and in the other case on the principle that ownership of a trade-mark, like that of a patent right, can only be acquired by sovereign grant.

It is rather well known that the laws of most Latin-American countries fall in the third class. This has given rise to the registration in those countries by natives of many foreign trade-marks the owners of which had for one reason or another neglected to apply for what might be called the privilege to use their mark in the countries in question. We, in the United States, have been accustomed to term these chaps "pirates" and they are indeed in most cases unscrupulous and deserving of the name. Nevertheless it must be admitted that in failing to take advantage of the laws of their countries, which may be considered liberal in that they will grant exclusive use of any mark to a foreign manufacturer and protect him in its use in return for the mere presentation of his claim with a small fee so that the native public may be notified of his rights, the real owners of the trade-marks were at least technically negligent.

The Buenos Aires Trade-Mark Convention of 1910 was the result of an attempt fostered by the United States to remedy this situation; and while Argentina, wherein more "piracy" has occurred than anywhere else, has not yet joined this convention, the agreement bids fair eventually to bring about a merger of the two systems of law that will be equitable and fair to all concerned. That the accomplishment of this much-to-be-desired state of affairs is not to be had, however, without considerable travail and trepidation is evidenced by the difficulties that have already been encountered in trying to bring about the enactment of necessary enabling legislation in the United States. Though the convention was proclaimed by our President in 1916 and should have been proclaimed still earlier, and although the Bureau at Havana has been in operation for more than a year, Congress has failed so far to make provision for the reciprocity provided for in the convention; so that it is more than doubtful whether our citizens are entitled to the benefits of this convention today.

As the first really serious convention of the sort, it is only natural that the framers, by the ambiguity of their verbiage, should have left undecided many of the most important differences among the nations represented. One of these is the right of one nation to examine and refuse recognition to a mark registered in Havana by a citizen of another contracting nation where such mark or a similar mark has been locally registered by another. The writer has steadfastly insisted upon our right to such examination, and has urged provision for the same until such examination has been eliminated from our whole trade-mark registration procedure; and Dr. Irizar, the Director of the Bureau at Havana, has acknowledged this right. Nevertheless, in deference to certain members of the last Senate who held a contrary opinion, the present bill to give effect to this convention, as presented to the present Congress and passed both houses, waives this right and provides for the placing of these marks on a separate register without any examination whatsoever. What more natural, therefore, than that domestic owners of trade-marks that are unregisterable under our present law should seek the same privilege of registration without examination? Particularly will this be the case with the owners of marks which, although protected in the United States, are unregistrable here. For these owners have heretofore been denied any protection whatever in foreign countries whose laws fall in the third group, since they cannot show that their marks enjoy any protection at all in the United States. Fortunately for these owners, this whole matter has come up for discussion at a time when the Commissioner of Patents is a liberal-minded gentleman notorious for his view that our law should be changed so as to put us among the countries of the first class. Due to him, more than to anyone else, the Senate has already given its approval to the establishment of a separate register on which may be placed any mark, regardless of its character, that has been in bona fide use as a trade-mark in interstate or foreign commerce for at least one year. Whether the House will also give its approval to this suggestion is problematical, although it is understood that the House Committee on Patents has pledged its support.

All of which goes to show that the United States is gradually steering its course from the first class to the second; while Latin-American countries, through their adherence to the Buenos Aires Convention and in other ways, are veering over from third class to the second. Those who have had to wrestle with the technical procedure under our examination system and with the problem of protecting, in foreign countries, perfectly good common-law trade-marks that could not be registered here as technical trade-marks, will welcome this evolution of trade-mark procedure—albeit they would rather have seen a single thorough and painstaking revision of our whole trade-mark registration procedure than the present piecemeal method.

EVERYBODY who attempts to do business under two flags finds himself more or less embarrassed by the fact that under no two flags are the laws identical. If we embark upon some enterprise in Argentine, or New Zealand or Japan or Norway, following the customary procedure of our home country with which we are so familiar, we are pretty certain sooner or later to omit some act which the foreign statute requires, or to do something upon which it frowns. Likewise we are very apt to assume that we have rights all over the world analogous to those which we possess at home, where the truth is that the moment we enter a foreign country we lose some of our familiar rights and acquire certain other unfamiliar ones. Nowhere is this lack of legislative uniformity among the nations more noticeable or more trying than in the trade-mark enactments which make it possible for a great business to find its competitors in foreign markets using its very marks, which it is itself forbidden to use. And in no department of law have greater efforts been made to compose the conflict between the laws and customs of different nations and secure some sort of a harmonious international working basis. The present article explains the nature of the adjustments necessary in doing this, and shows the extent to which they have been successfully made in the United States and in foreign countries with reference to United States trade-marks.—THE EDITOR.

A New Flotation Agent

TOLUIDIN, as a new flotation agent, is the subject of a patent recently issued to C. L. Perkins, who has been working along the lines followed by the late H. P. Corless. The use of toluidin is an application of the principles involved in utilizing alpha-naphthylamine (X-cake) and xylidin. In his patent specification, Mr. Perkins describes the following experiment:

Five hundred parts of ore was ground in a pebble mill with 250 parts of water; sodium hydroxide equivalent to 2 pounds per ton of ore was added, and commercial mixed toluidin equivalent to 1 pound per ton. The resulting pulp was placed in a Callow cell, with sufficient water to form a free-flowing pulp. The Utah ore treated contained about 1.42 per cent of copper. The concentrates produced contained about 15.4 per cent of copper, and the recovery of the copper was about 87 per cent. The use of alkali is not necessary in all cases, but it has been found greatly to improve the recovery.

The froth obtained is readily broken up, and the toluidin is recovered therefrom so that it is then available for use in the treatment of further amounts of ore.

The toluidin may be used alone to promote the flotation operation, and high grades of concentrates obtained; and the resulting concentrates can be much more easily separated by filtration than the common concentrate obtained by the use of oil.

The action of the toluidin may, however, be modified or supplemented by adding other agents (such as oils or non-oleaginous agents).

In applying the toluidin, it may be introduced into the tube mill in which the ore is being ground, or by dropping it into the ore pulp before it enters the flotation cell, or by first digesting it in hot water and mixing the product with the ore pulp.

Thin Steel Belts for Magnetized Pulleys

THE use of thin steel or iron belts on magnetized pulleys to transmit power has been patented in France. The magnetization of the pulleys is effected by windings lying in helicoidal slots on the surface of the pulleys. The thickness of the belt should not exceed about 0.06 times the diameter of the smallest pulley. With a steel belt of 1/6 inch thickness making contact over an arc of 145 degrees on a pulley of 10 inches diameter running at 4,000 revolutions per minute, it is possible to transmit more than 200 horse-power per inch width of belt. With a pulley of 50 inches diameter running at 800 revolutions per minute, a belt of 1 inch width will transmit 1,000 horse-power. Steel belts may be run at speeds of 18,000 feet per minute so that this method of transmission is suitable for speed reduction with turbines.

Automobile Body Polish

A MUCH recommended automobile body polish is made by mixing the following ingredients and will commend itself to motorists who like to keep their cars in good condition:

Turpentine, 1 gallon; paraffine oil, 1 pint; oil of citronella, 3½ ounces; oil of cedar, 1½ ounces. Another scheme is to use a mixture of boiled linseed oil and turpentine, applying it sparingly and rubbing absolutely dry. The use of these polishes will restore even an old car to a degree of brightness that will please the owner. Floor wax is also used, as is furniture polish.

Possum Wood

A Little-Known Forest Product That Seems Certain to Find a Place in Our Economy

By Professor Samuel J. Record, Yale University

POSSUM wood is the name of the most recent introduction to the American timber market. It has not yet established a place but the indications are that sooner or later it will. The writer first met it under this name at the Navy Yard at Philadelphia where it was being considered for use in airplane construction. No reference has been found in literature to "possum wood," so it is assumed that the name is a corruption of some native word. It is said to be known as "possum wood" in Dutch Guiana, but the writer has been unable to confirm this.

The botanical name of "possum wood" is *Hura crepitans*. It belongs to the Euphorbiaceæ or Spurge family which in our flora has only a few insignificant trees in southern Florida, but many herbaceous plants of wide distribution. The castor oil plant belongs to this family.

The tree grows naturally in tropical America from the Antilles and Costa Rica to the northern states of Brazil and Bolivia. It is widely cultivated not only in its native habitat but also in the tropics of the Old World.

It has many names. In the West Indies it is often called the Sand-box tree by the English, while the natives refer to it as Sabbir, Javillo, or Havillo. In Cuba, where it is a common street tree, it is usually known as Salvadera. In Colombia it is commonly Jabillo; in Venezuela the same or Ceiba de Leche; in Bolivia, Ochohó; in Brazil, Arceira and Assacú (also Oassacú), Guassacú and Uassacú; in Java, Ki-semir.

The tree grows usually in moist locations in lowlands and along water courses, in mixture with other trees of the forest. It attains large dimensions, diameters of from 6 to 9 feet and heights of a hundred feet or so, being fairly common. Very often it is thick and short-boled with coarse branches producing a wide spreading crown. The bark is smooth except for a multitude of conical spines on the lower portions, resembling the ceiba or kapok (silk floss) tree. It contains a juice said to be poisonous and on this account the natives in certain regions shun the tree. They claim that the liquid is likely to spurt in the eyes in cutting and cause blindness.

The tree has a leaf suggesting that of the Carolina poplar. The flowers are small, dark red and borne in small cones which are conspicuous because of their large number. The fruits are round, flattened and segmented, looking much like miniature pumpkins. These, when ripened, burst with a sharp report into fifteen twisted, clawlike fragments, and scatter the wafer-like seeds. The latter are about the size of a 5-cent coin.

It seems to be a common practice to collect perfect specimens of the unripened fruits and fill them with molten lead for paper weights. As a small box full of sand for blotting purposes was formerly also used for a paper weight it is presumed that it is due to some such association that the name "Sand-box" came to be applied to the tree.

The wood, which may be had in large sizes, is almost devoid of color or somewhat yellowish, and has a silky luster. It is of about the consistency of basswood, but has a few rather large scattered pores and the grain is more or less "roey" or "feathery" as is usually the case with tropical woods. Though light in weight it is firm and of good strength and tenacity.

In Colombia it is commonly in the market in small quantities and is used as a cheap substitute for Spanish cedar though its lack of color is against it. It is extensively used in Venezuela, being more common on the market than any other native timber. Much is cut along Lake Maracaibo and shipped by steamer to the coast ports where it finds a ready sale as a substitute for pine in cheap construction and in the manufacture of crates and boxes.

With increase in price of our coniferous woods it is likely that more and more attention will be directed to "possum wood." Inquiry has come to the writer concerning its suitability for paper pulp. Efforts to stain the wood have met with success and may prompt some enterprising exploiter to add yet another "mahogany" to the growing list of spurious kinds. Its advent into our market will mark the beginning of a change in our relations to the tropical forests which up to the present have been called upon to supply only the rarer kinds for cabinet and special purposes. It is a sign that our once vast forest resources are being seriously depleted.

Clearing the Garden of Grubs

A VERY large proportion of grubs and caterpillars that plague the gardener spend a good deal of their time underground. In most cases they do not go down to any great depth but they are quite invisible when the grower hunts for the pests which are damaging his crops. Only during the hours of darkness do these grubs come up to the surface to carry on their work of destruction. A most effectual way of clearing ground of pests of any sort that lurk in the soil is on the following lines: Get a quarter of a pound of soft soap, or the same amount of any good washing soap would do as well. Now boil about a quart of water in a can and dissolve the soap in this. When all trace of the soap in its solid state has disappeared mix the solution in a tub with four gallons of cold water.

Take a watering pot and, with a nose on it, use to apply the mixture to the ground. It does not matter in the least whether there are growing plants for the solution will do no harm to vegetation. Treat the ground piece by piece watching closely as the soapy water sinks in. Almost at once the grubs and caterpillars come up and, without delay, they should be collected and destroyed. Do not give them a chance to retreat below the surface again. Land may be entirely cleared of all manner of pests that lurk underground by following this simple plan.—By *S. Leonard Bastin.*

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Supremacy of the Battleship

To the Editor of the SCIENTIFIC AMERICAN:

In the course of a lecture delivered to the Institution of Naval Architects, Sir Eustace d' Eyncourt, director of naval construction for the Admiralty, recently uncovered the secrets embodied in H. M. S. "Hood," the remarkable new flagship of the Atlantic Squadron. Many a person was caused to wonder at the astonishing frankness with which Sir Eustace explained the intricacies of this colossal vessel's secret construction for, to be sure, she is the embodiment of everything England learned at Jutland and from the surrendered German warships. Why this extraordinary revealment?

The significance of the disclosure was brought out by Admiral Sir Alfred Chatfield when, speaking in regard to Britain's cessation of dreadnought construction, he said that were England to build a new ship today it would not be of the "Hood" type. This is nothing more or nothing less than a hint that so far as the present type of dreadnought is concerned, Great Britain is through. London is astir with rumors to the effect that plans are being developed for a new type of big capital ship totally different from anything we now have.

To say the least these items ought to interest the American taxpayer when he stops to remind himself of the fact that $400,000,000 are to be expended on new dreadnoughts and battle-cruisers for the U. S. Navy within the next few years. Col. Alan H. Burgoyne, M.P., says: "America is making a big mistake. By the time the ships planned under her building program are commissioned, they will be nearer the scrap heap than any others in all naval history. Britain's supremacy on the seas is today more complete than ever before. This position will remain ours despite American progress."

Just how much truth is contained in these bold assertions remains to be seen. The present type of dreadnought may be with us for some time yet but such authorities as Rear-Admirals Fiske and Fullam tell us that its supremacy has never been so threatened as it is today. It is, they say, extremely doubtful if defensive means and measures can grow apace with the attacking power of the torpedo-plane and fast bombing plane, and the destructive plunging fire of big guns.

On this question we have the words of Rear-Admiral W. F. Fullam, U.S.N.: "It is probable that a complete revolution in naval architecture will be forced upon us in the near future and that present types of dreadnoughts and battle-cruisers will be driven from the sea. Sea power or fighting power in the future will be largely dependent upon control of the air, and that fleet that secures this control in future battles must win, other things being approximately equal."

In connection with this phase of the question, a London correspondent of the *Chicago Herald and Examiner* reports: "The greatest secrecy attends the construction by Britain of gigantic eight-engined flying boats, each of 6,000 horse-power and able to alight on land or sea."

Apart from this, however, there is reason to believe that England's cessation of dreadnought construction was not actuated by economic motives alone. Apparently those men who are responsible for her ships of war desire more time in which to study further and apply the lessons just learned. For the present at least, her supremacy is safe and she can afford to suspend building temporarily. More important than this, it is evident that England is at work on new plans. Whether or not these disquieting rumors are to be believed, they are supported by the general appearance of things, and we ask the question: Is England about to spring something which will render obsolete the prevailing type of dreadnought?

The question which the American taxpayer asks, however, is this: Is the United States making a mistake in going ahead on its extravagant building program at this time?

WILLIAM D. REICHMANN.

Kenilworth, Illinois.

[*As was pointed out in the article on the "Hood," which appeared in the* SCIENTIFIC AMERICAN *of May 1st, the British Admiralty have recently said: "In our opinion the capital ship remains the unit on which sea power is built up." The bulge was proved to be an effective protection against the torpedo, as such, whether it be fired by discharge, submarine, or torpedo plane. Bomb-dropping from airplanes is too inaccurate, in the present state of the art, to constitute a serious peril.*—EDITOR.]

Bad Weather and Good

To the Editor of the SCIENTIFIC AMERICAN:

The writer of "Animal Weather Prophets," in your issue of March 20, has curiously snarled his facts. He says: "The lighter the atmosphere, as in the case of fair weather or clearing weather, the higher will insects be found; while an oncoming storm, presaged by growing density, forces them to levels near the ground, where the swallows will be noticed in pursuit of them."

Your writer misses the truth "both coming and going." Fair weather means a high barometer, or heavy atmosphere; stormy weather means a "low," in Weather Bureau parlance, or light atmosphere. Insects fly high in fair weather just because the atmosphere is heavy, that is, easily supports them; and they fly low in stormy or unsettled weather for the opposite reason, or for the same reason that smoke then comes to the ground, namely, because the light atmosphere does not readily support them.

ELMORE ELLIOTT PEAKE.

La Grange, Ill.

Why Is Hydrogen?

To the Editor of the SCIENTIFIC AMERICAN:

I read with great interest Dr. Langmuir's article, "At the Rock Bottom of Matter," in your issue of April 17th.

I do not in any way intend to reflect upon the excellence of the article, but I fail to find the answer to the terse question "Why is Hydrogen?" This fundamental question has to be answered before the "Rock Bottom of Matter" is reached.

Please put this question to the readers of your correspondence column and oblige.

GUNNAR C. ENGSTRAND.

New York.

Left: Dr. W. R. Whitney, director of the General Electric Research Laboratory, and Dr. Irving Langmuir, an assistant director whose recent work in atomic structures has attracted wide attention. *Center,* Pouring liquid air at 320 degrees below zero, near the condenser of the liquid air machine. *Right:* Squirting pulverized tungsten ore into the 1200-degree furnace, which removes oxygen and produces pure tungsten in powder form.

Two of the men of the Schenectady research laboratory and two extremes in the work done in this interesting institution

The Laboratory in Business

How Science and Industry Have Linked Hands in the Industrial Laboratory

SCIENCE and industry have joined forces for the benefit of humanity in the industrial laboratories which many big manufacturing plants maintain today. Here constant ranging into untrodden fields has enabled industry to produce better goods at greater speed and at less cost to the ultimate consumer. Thus has tungsten been adapted for lamp filaments, reducing the American public's electric light bill for 1919 by a billion dollars. Thus has the X-ray been improved and compacted so that not only was it taken on the fields of battle in the European war to save lives, but a doctor may now carry it to the bedside, in the home, make accurate photographs and prevent untold suffering and life-long deformity.

So innumerable indeed are the triumphs of industrial research that there is no accurate way of computing its cash value to American industry or to the American public. Time and again it has been proved that coöperation between industry and science in research is an investment which will return large dividends; and today even the "hard-headed business men" of the type which once scorned scientists as impracticable, is employing corps of potential inventors for their practical value. It is this changed attitude through the various strata of American business that may soon make possible the establishment in all "land grant" colleges of government research laboratories where industrial problems can be solved.

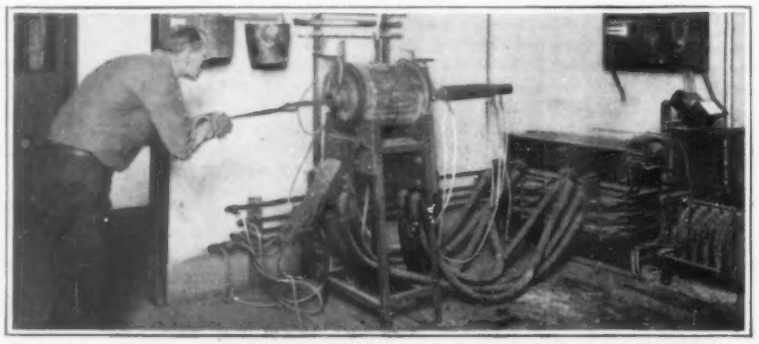
As far back as 1913, when research was progressing but not booming, Arthur D. Little, president of the American Chemical Society, said in an annual report that while the United States might have been sluggish in research, yet "the country of Franklin, Morse and Rumford, of McCormick, Howe and Whitney, of Edison, Thomson and Bell, and of William and Orville Wright, is not hostile to industrial research or unable to apply it to good purposes. Once our resources permitted us to enter upon our inheritance with the spirit of a spendthrift but that day has gone. American business realizes that efficiency of production is a sounder basis for prosperity than more volume of business."

He pointed out that even up to 1913 research had reduced labor cost in agriculture 681 million dollars a year as measured by the methods of 50 years before that. Further illustrating the cash value of research he cited the fact that while aluminum was discovered in 1828, and was selling for $90 a pound in 1855 and for $4 in 1893, by 1913 it had been brought down to 22 cents.

There are today probably more than 100 research laboratories working for the good of industry and the people. Some of those which have stood out prominently in the service they have performed are maintained by the United States Government, and others by great industrial corporations and associations.

Of course every problem presented is not solved at once by a group of scientists simply because they happen to be installed in a properly equipped laboratory. The fact is many an experiment has resulted in nothing. But by the same sign, many a valuable discovery has been stumbled upon by purest accident. Take for instance the case of Dr. Irving Langmuir, who discovered unintentionally the tremendous increase in efficiency obtainable from the large-sized incandescent lamps by filling them with argon gas. He had merely been measuring the heat given off by wire of various sizes to aid in making better electric toasters and at the same time had been measuring the evaporation of tungsten at incandescence, when his remarkable service to the light users of the world was rendered. Thus it has been with other discoveries, but the value to the electrical industry of the almost daily improvement of this or that method or material has made the great Schenectady laboratory worth the $900,000 spent to operate it last year.

TIME was when there was a great gulf between science and industry. The captains of commerce and trade looked down upon the guiding spirits of the laboratory as impractical dreamers, but they looked down upon them no more than they in turn were looked down upon by the scientists as money-grubbers with dead souls. Today the business man has learned that he cannot get along without the trained scientist; but that is only half the picture, for the scientist at the same time has discovered how essential to him is the support of the business man. It is this double reconciliation of science and industry, each to the other, that has made possible the modern research laboratory and the methods of organized invention that mean so much to twentieth-century science and twentieth-century industry. —THE EDITOR.



Inserting a bar of metal into the molybdenum furnace operating at 5,000 degrees above zero—approximately the sun's heat

To an extent this particular laboratory is typical of research laboratories all over the country but because of its size and efficiency, it is worth studying. The average householder would be interested to see just what sort of place and what sort of people it was that save his or her share of the billion dollars' reduction in the 1919 electric light bill.

It occupies four expansive floors of a seven-story $750,000 building. Inside those four floors is equipment ranging from swages and steel rolling mills to the most fragile glass fabric and scales delicate enough to weigh accurately an inch of a spider's web. This equipment is used by brawny machinists at union wages, youths cleaning test tubes at office boy's pay, and able inventors and electrical engineers of all grades and specialties up to a group of the most noted of American physicists and chemists, such as Drs. W. D. Coolidge, Irving Langmuir, A. W. Hull and Saul Dushman. The $900,000 gross expenditure on this laboratory last year included a payroll carrying 275 names, of whom 75 are physicists, chemists, metallurgists and engineers—in a word, organized inventors.

Properly to support all the machinery and equipment which fills row upon row of rooms and whose secrets are guarded by "No Admittance Except by Special Pass" signs, it is necessary to fill the walls of this building with no less than 50 miles of piping and 30 miles of power lines of various kinds. These pipes carry low pressure hydrogen in which to melt metals in a non-oxidizing atmosphere; high pressure hydrogen used in melting glass and in high temperature blow torches; illuminating gas; compressed air; high pressure oxygen; vacuum for cleaning purposes; high pressure steam for heating and treating compounds under steam pressure; low pressure steam for heating the building; city water; distilled water; river water; waste water; and nitrogen for filling tubes. Every type of equipment and machine necessary to delving into the intricacies of electricity is at hand, from a machine producing liquid air at 320 degrees below zero, to a little barrel molybdenum furnace capable of melting firebrick or sapphire at 5,000 degrees, or approximating the heat of the sun itself.

A privileged visitor strolling through the halls might look first into a room where, amidst a mass of glass and electrical devices, he sees a man or two, or a

(*Continued on page 582*)

The Portaphone—A Wireless Set for Dance Music or the Day's News

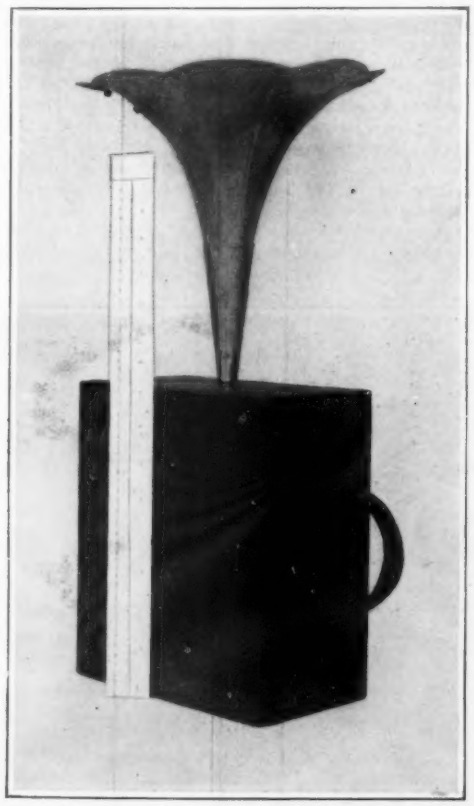
THOSE who have not kept pace with the developments in radio communication are apt to think of the wireless telegraph or telephone as a complicated arrangement of delicate apparatus, involving also aerial wires and an array of various devices formidable and involved in appearance. They would be surprised indeed to learn that a receiving instrument—the Portaphone—has been developed in the Radio Section of the United States Bureau of Standards at Washington, which, packed in an ordinary case, can be transported with much less difficulty than a simple talking machine, and which may be placed anywhere and receive wireless impulses in the form of signals, music or speech, reproducing the same through a loud-speaking telephone and horn as shown in the illustrations below.

It will appear from the scale placed alongside of the portaphone, that its height is some 12 inches exclusive of the horn, while the compactness of the apparatus is shown in the view representing its interior. This device, furthermore, does not require an expert operator, but may be arranged by any one without previous special knowledge or training.

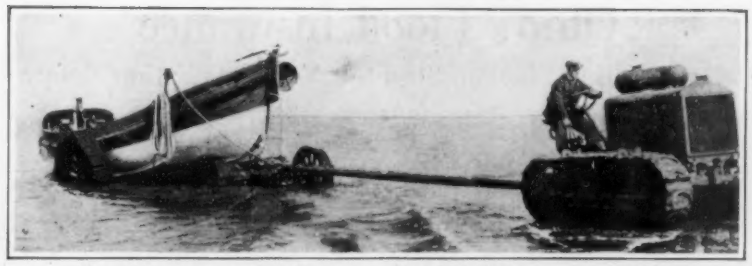
The portaphone opens up many new possibilities. For instance, at 8:30 o'clock each evening a central station might send out dance music from its transmitting apparatus and those who cared to dance could set up their portaphones on a table, turn on the current and have the music furnished sufficiently loud to fill a small room. Or in the morning a summary of the day's news might be sent out to be received by a portaphone and digested by a family at breakfast, in which all could participate whether paterfamilias had the paper or not.

Obviously there are a number of other applications of this simple device which serves to reproduce sound from the waves sent through space. A glance at the apparatus shows its simplicity. On the inside of the door of the case is shown a rectangle of wire forming the radio compass, direction coil, or "loops," which takes the place of the usual elevated aerial or antenna. The capacity can be adjusted so as to tune the apparatus to the required wave length. The receiving set makes use of a vacuum tube detector and a two-stage amplifier, all operated by dry cells. The signals are passed on to a special loud-speaking telephone to make the vibrations audible, while the large horn reinforces the sound waves until they completely fill a small room.

The instrument as constructed at present has a range of about 15 miles, or well within the limits of an ordinary city. The impulses sent out can be of such a wave length as not to interfere with commercial wireless. The instrument is not sufficiently sensitive to respond to the ordinary long-distance signals coming from Government or marine or commercial stations. So far the only application of the portaphone has been purely experimental at the Bureau of Standards, but it presents interesting possibilities for more general and utilitarian applications. A similar device with a larger coil has been built there in the Radio Section, which develops sufficient power in connection with a transmission source to reproduce music loud enough to fill a very large room suitable for dancing.—By *Herbert T. Wade.*



The portaphone alongside a 20-inch rule, showing its relative size



This 40-horsepower gasoline tractor handles lifeboats at an English life-saving station

When the Tractor Hauls the Life-Boat

ENGLAND has found a new application for the caterpillar tractor—the peacetime version of the "tank." This is in the form of a 40-horse-power tractor which is now being used at Hunstanton, England, to run the life-boats to and from the sea. As will be noted in the accompanying illustration, the life-boat to be taken into and out of the water, is mounted on a truck provided with two plain wheels and two caterpillar wheels. This truck is hauled or pushed by the tractor through the medium of a stout forty-nine-foot spar.

It is reported that this method of handling life-boats has met with a complete success, especially with the large and cumbersome life-boats now in general use.—By *Ralph Howard.*

General view of the postal pillar box of Toronto, Canada, and a near view of the stamp-vending feature

A Post Office at Every Important Street Corner

IN the case of four out of every five correspondents, the usual mail box on the street corner is only one-half the problem of mailing a letter. The other half consists in hunting up a post office, drugstore or other place where stamps can be obtained. For it is a fact that very few persons carry postage stamps about with them, so as to be always ready to mail any given piece of mail matter.

So it has remained for the enterprising city of Toronto, Canada, to make the mail box really complete; that is to say, combine it with a stamp-vending machine so that any one can mail a letter or package at any time. The most remarkable fact about this street-corner post office, for such it is in a practical sense, is that a private company and not the postal authorities operate it. Of course, the mail collections are carried on by the usual postal officials, but the vending of stamps is handled by a private company, which derives its revenue from the small percentage on stamps but mainly from advertisements at the top of the postal pillar box. At night the advertising signs are brilliantly illuminated, and the display advertisements revolve continually.

As will be noted in the close-up view, the machine handles one-cent and two-cent stamps, which are delivered in continuous strips.—By *George Gaulois.*

New System of British Patent Numbers

IT is not sufficiently well known among inventors and others that the Comptroller of the British Patent Office has instituted a new system of enumeration within the past year or two. In the old days applications for patents were entered serially, No. 1 beginning on January 1 of each year, and there used to be some friendly rivalry among patent agents to secure that coveted number. This application number became eventually the number of the patent, and particulars of it could be easily traced if the year was also indicated in any correspondence relating to it. Some applications were never completed, and consequently there were gaps in the lists finally published. Two years or more ago it was decided that from that date the application should bear one number and the patent proper another, and that the latter should be in a series which, beginning with the number 100,000, was to be continued year after year. Would-be patentees have been warned since that the application number must not be used to indicate the patent, but there seems to be a tendency to quote these numbers when an invention is introduced to the public after provisional protection has been granted and before the patent is sealed. Owing to the method of printing the register it is no longer easy for anyone to trace these application numbers, and in the interests of future business it is to be hoped that manufacturers and others will refrain from using any numbers in connection with marks they may put upon articles, except the six-digit number.

Portaphone with case open to show the loop antenna and detecting and amplifying apparatus

Ohio's Flood Insurance

How the Miami Valley Plans to Stop the Next Inundation Before It Starts

By M. A. Henry

1. View of one of the completed dams. 2. A partly completed spillway; a great concrete wedge will ultimately fill all but a small passage through this opening. 3. A finished spillway.

The storage and outlet system that will make the Miami Valley safe from floods

THE coming summer will see brought to virtual completion five great dams near Dayton, Ohio, costing $25,000,000, representing at once the most daring and comprehensive flood prevention project ever undertaken in this country.

Final stages of the work involve the moving of a whole village of 1,000 population two miles across country to get it out of the basin behind one of the dams. Several highways and railroad lines will also be moved.

Work on the project has been under way for some three years, and it has been brought to a stage where a few quick strokes will put the system in operation. Two or three years more will be required to put finishing touches on the work, but the essential features will be completed before snow flies again, if the present program is carried out.

The flood prevention project was inspired by the great flood of 1913, in which Dayton suffered the loss of many lives and millions of dollars in property damage. The great damage at Dayton was due to the sudden rise of two rivers, the Miami and Mad River, which meet within the city limits. It was early recognized that any local measures undertaken by the city, such as the widening and deepening of the channels and the building of dykes, would only serve to increase the danger to other cities of the Miami Valley, below Dayton. These cities, chief among them being Hamilton were also heavy sufferers from the flood, and each was considering some preventive measures. The matter finally crystallized into combined effort. Special legislation was secured welding all the affected area into a "conservancy district" and creating a "conservancy board" with governmental powers over this district. The board levies taxes to meet its expenses, has set up its own community governments at the dam-sites, has its own schools for the children of the workmen, and exercises general governmental authority over the district independent of state, county or city governments.

The flood prevention plan adopted by the Conservancy Board is unique in this country, although it has been tried with success on a smaller scale in Europe.

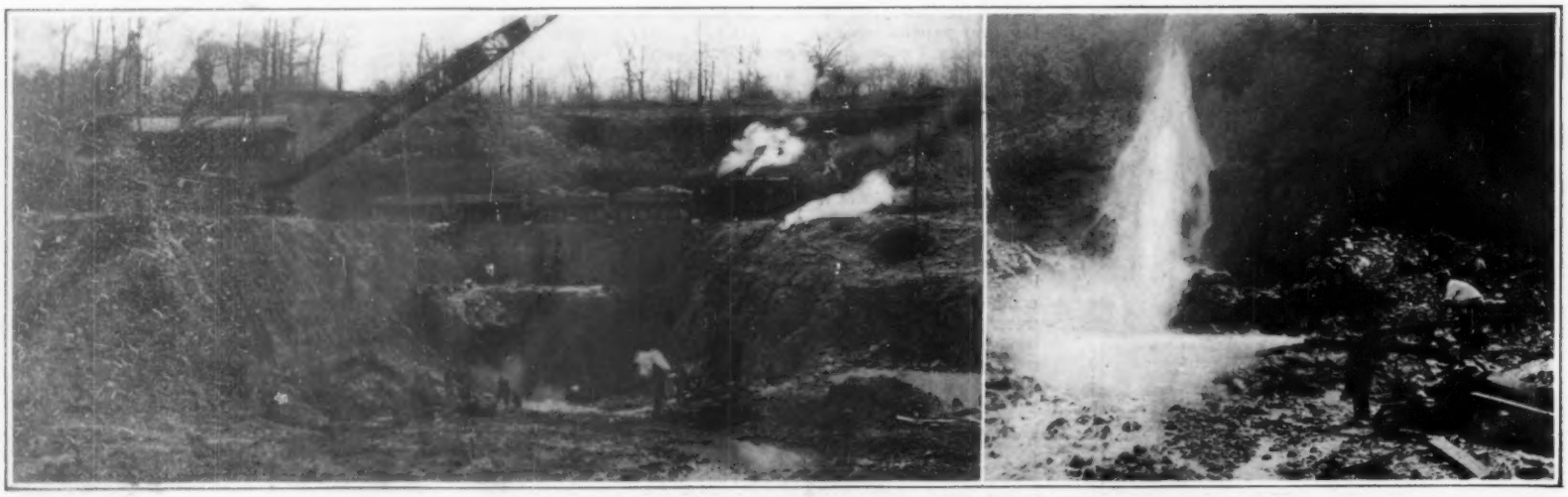
Three dams are being thrown across the valleys of tributaries of the Miami, above the city of Dayton, and two dams below the city. Normally, these dams will hold no water behind them, and the rivers will flow through spillways just large enough to accommodate a little more than normal flow. But in time of flood, the water being unable to pass through the spillways, will back up behind the dams. Spillways over the tops of the dams are also provided against the remote possibility that the water will reach such a height. The capacity of the dam basins has been calculated to care for even greater floods than have yet been experienced in the Miami Valley. When the crest of the flood passes, the water behind the dam is automatically released at a rate easily cared for by the river channel.

The first step was the purchase of all the land within the proposed basins. This included thousands of acres of valuable farm land, and one entire village. A strip of land above the high water line was also purchased around each basin. When the work is completed, all of this land will be laid out in farms and resold. Each farm will have space for the buildings above the water line, and the farmer only faces the prospect of having his fields inundated by occasional floods. It is anticipated that the floods will enrich the land more than enough to compensate for any damage done.

The village of Osborne, eight miles north of Dayton, fell within the condemned area. All of the property was purchased by the Conservancy Board and the citizens were told they must hunt new homes. The town was to be razed. The citizens protested against annihilation of the town, and at one time a proposition to allow them to remain at their own risk was considered. But recently the citizens organized a company for the purpose of moving the town out of the danger zone. The Conservancy Board has sold them land for the relocation and has promised to assist in the enterprise. Two tramways are to be built across almost level fields to the new site and all of the substantial buildings of the town will be moved on them. Those homes which are torn down will be replaced by model cottages of the type erected by the Conservancy Board for its workmen. The town is being planned as a model village with sections for cottages, two- and three-story houses, factories, parks, business district, etc. It is expected the moving will be completed this summer. Three railroads which run through the town, two steam roads and an electric line, will be relocated so as to pass through the new town site.

The method of constructing the dams is also believed to be unique in this country. The so-called "hydraulic fill" method is being used. Instead of hauling the earth to the dam in cars or trucks, it is mixed with water and pumped to the dam as mud. First,

(Continued on page 584)



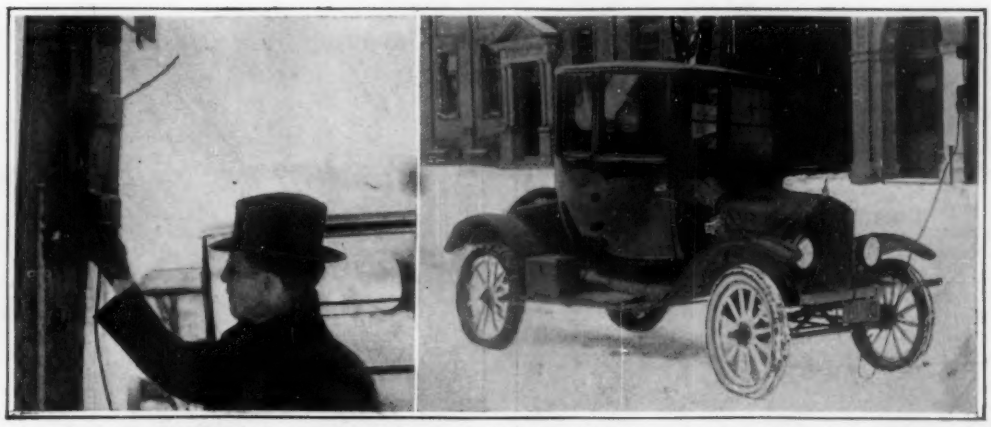
Left: Removing rock for the foundation of one of the big dams. *Right:* Washing down earth from a hillside for the filling of the dam.

Taking material away from where it isn't wanted and putting it where it is wanted

Tapping the Power Line to Keep the Car Warm

TO the city of London, Ontario, Canada, belongs the credit for installing a very novel system by which the radiators of automobiles may be kept warm and safe from freezing, while standing outdoors in the coldest weather.

The local electric light and power company has installed simple current taps at convenient points about the city. Anyone wishing to take advantage of this system of keeping the automobile warm, pays an annual fee to the electric company and receives a key that gives access to the current taps, as well as a radiator heater and connecting cord. The cord is provided with a special license plate so that the company's inspectors at any time can detect fraudulent users. The two accompanying views show how the connection is made to the first convenient pole in the heart of the city.



Current taps, installed at convenient points, permit automobile drivers to keep their radiators warm while leaving the car standing in winter weather

Protecting Molten Alloys from Oxidation

A DIFFICULTY in melting alloys and some metals, is the oxidation of the metal, whereby serious loss of material occurs. To meet this difficulty, it is a common practice to fill the container with a neutral gas so as to effect the fusion in a neutral atmosphere. But the usual arrangements allow the neutral gas to escape, its place being taken by air from the surrounding atmosphere. As a consequence, some oxidation still occurs. An invention, patented in Germany, remedies this effect. The container in which the metal is melted is constructed to be closed air-tight, and put in communication with a compressed air-cylinder filled with nitrogen. The gas, under a pressure of 60 to 70 atmospheres, may be led into the container through a reducing valve.—*Technische Blatt.*

Coal Storage by Scoop Conveyers

AN interesting application of scoop conveyers for storing coal is shown in the accompanying view, where five machines are being used to unload coal from hopper-bottom cars direct to the storage pile. Four of these machines are 12 inches wide by 24 feet long, the other one being 12 inches by 20 feet. Each is equipped with its own electric motor and can be operated singly if desired.

These machines provide a convenient, efficient and flexible arrangement. The first machine is practically self-feeding from the hopper doors of the car and the other four may be swung around at any angle to cover a wide storage area. Five machines arranged in this manner can be operated by one or two men. They can also be used to convey the coal direct from storage pile into boiler room, or where desired, one machine can be used to load an electric storage battery truck to convey the coal directly into the boiler room.

The advantages of using several conveyers of moderate length are quite obvious. One long conveyer would not be as portable. It would be more difficult to adjust and handle and the shorter units can always be used to better advantage for general work about the plant.

A great advantage of using the scoop conveyer to unload hopper-bottom cars is the fact that no track hopper or pit is necessary. This makes it possible to unload cars at any point along the track. To unload a car, the scoop or feed end of the machine is placed near or under the car hopper. The hopper door is then released and the belt on the scoop conveyer carries the material away as fast as it flows through the hopper opening.—By *H. C. Hardy.*

A chain of five portable conveyers delivering coal from the car to the pile

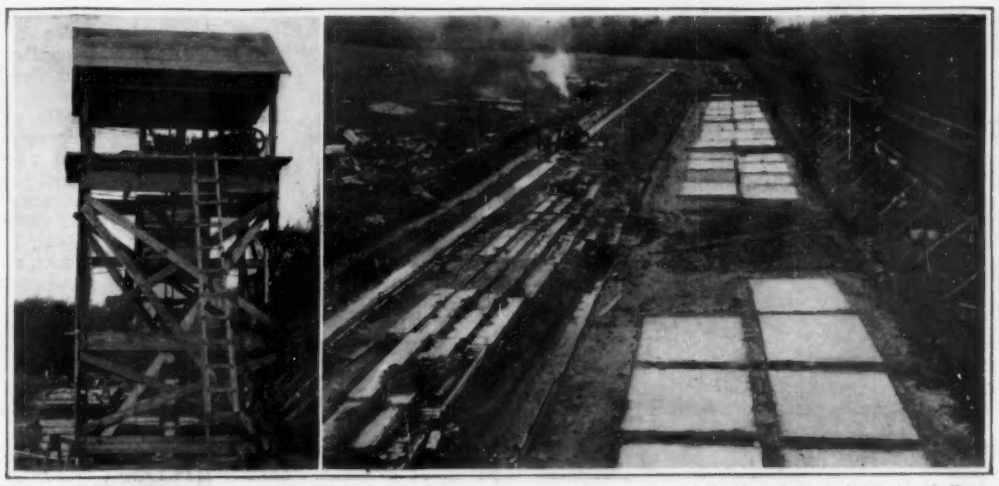
"Boils" on Asphalt Pavements

WITHIN a few months after an asphalt pavement was put down in the City of Bakersfield, Cal., peculiar round swellings or "boils" began to appear at frequent intervals in one section of the work, says a prominent engineering journal. The pavement seemed to be sound in every respect except for this stretch of about 1,000 feet long, in which scores of the boils slowly but steadily rose. The boils grew until the larger ones were 2 or 3 inches high at the center and disturbed the pavement within a circle about 2 feet in diameter. The smaller ones were sharper. All of them showed central cracks, more or less radial. In fact, radial cracks usually appeared with the first susceptible swelling.

When one of the largest of the boils was opened a lens-shaped mass of copper sulfate crystal was found. In others were found crystal formations of various sizes and stages of development, some with a nucleus of copper or zinc still remaining in metallic form. After removing these causes of the disturbances and after patching the pavement there was no further trouble. Some of the boils which were not opened have since somewhat subsided. The pavement has now been down about two years.

The suggestion of a possible cause, as made by R. W. Whitaker, city engineer, is as follows: This particular stretch of the paving was laid on a fill 1 to 2 feet deep placed over an old oiled surface. Material for the fill, the typical sandy formation of this part of the valley, was taken from a spot on which a garage, full of automobiles, burned to the ground about ten years ago. Evidently metal scraps were left in the ground at the site of this fire. Before placing the paving on the fill the latter was well soaked. Something leached from the asphalt, possibly a sulfur compound, which attacked the metal.

The pavement has a 4-inch asphaltic concrete base and a 1½-inch sheet asphalt top, the asphalt in both cases being 70-80 penetration, refined from California petroleum. The interesting question which naturally suggests itself is: What attacked the metal?



Left: **The impact machine which duplicates the conditions of sprung and unsprung weights that characterize motor traffic.**
Right: **Forty-nine different types of road being tested at Arlington, Va., by the impact tower and other means.**

How the Bureau of Public Roads learns what is best in highway construction

The Impact Tower

MOTOR-truck traffic with all its facilities for bearing enormous cargoes of freight and attendant speedy distribution of products, has introduced fresh problems for solution by the highway engineer. Road construction designed to withstand the wear of buggies and wagons obviously is inadequate to the tasks imposed by heavy motor-truck traffic. While accepting the verity of this general conclusion, the road engineer must definitely ascertain the extent of the force of impact exerted by motor-driven vehicles.

Consequently, the U. S. Bureau of Public Roads has rigged up an impacting machine at the Government experiment farm, Arlington, Va., where assortments of road slabs of varying thickness are subjected to the impact pressure delivered to road surfaces by motor-truck traffic. The experimental machinery, towering skyward, consists of a weight of 2,000 pounds supported on a rubber tire; supplementing this there is another weight of 6,000 pounds supported on a heavy spring not dissimilar to those used in the mechanism of motor-driven vehicles. The combined weight of 8,000 pounds is elevated slightly and is permitted to fall repeatedly on the test slabs. Precise observations are made as to the results.

Inasmuch as the slabs vary in the type of construction and thickness, the highway engineers are hopeful of obtaining scientific information as to the load-carrying capacity of different road surfaces when subjected to motor-power conveyances. The objective of the experiments is to ultimately place highway designing on a parity with bridge construction, the designing engineer having advance knowledge of the behavior of certain materials when subjected repeatedly to loads of specified weights. Bridge construction has been reduced to an exact science—such is the goal established for road building. —By *S. R. Winters.*

Exposure—1½ minutes. The photographer intended giving only one minute, but a street cleaner left his hand-cart at the side door and removed it after ¾ minute, so an extra ½ minute was added to help obliterate the cart. Note the blur at the right center.

Typical pin-hole photograph, showing elimination of moving objects

Exposure—8 hours. This interior was photographed on a dull day, the church being only dimly lighted. The shutter of the pin-hole camera was left open from 9.00 A. M. to 5.00 P.M. Note the pleasing lighting effects brought out in this print.

Indoor pin-hole exposure of long duration, on a very dull day

Pin-Hole Photography

Some New and Pertinent Facts About an Old But Misunderstood Art

By J. F. Springer

A UNIVERSAL machine of any type is apt to be a very valuable piece of apparatus, because it meets a wide range of purposes. The human arm, the hand, the leg, the foot—all are universal mechanisms, each and every one being adapted to function under a considerable range of circumstances and to effect satisfactorily the corresponding purposes. Thus, with the hand, one may pull; push, lift, grasp, twist, and so on. In the machine shop the engine lathe is a universal machine, this apparatus having a very wide sphere of activity. However, in just about all such devices, something is given up in respect perhaps to each and every line of activity, in order to secure generality of application. By restricting the sphere of activity, opportunity is generally secured to make the device more effective. Thus, if the hand were expected to do nothing but push, probably a more advantageous arrangement of bones, joints, tendons and muscles is conceivable. So also with the engine lathe—if it meets a single purpose, changes of advantage become possible. In fact, there are such things as single-purpose lathes.

The modern complex camera with its capacity of adjustment, in order to make it usable under many diverse conditions, is a universal machine. Probably, if the functions were divided up among a considerable number of special-purpose cameras, each of these special devices could be made extraordinarily effective. Further, even if nothing in effectiveness be gained, it may often be the case that the single-purpose camera will do all that the owner wants it to do and will be so much simpler than the universal apparatus as to be comparatively inexpensive.

The *pin-hole camera* is a case in point. It will do only a few things, but it will do them exceedingly well and it is absurdly economical to make. There is no lens; so that at one stroke the principal item of expense in a modern camera is eliminated. One may readily convince himself that, by passing light from an illuminated object through a pin-hole and receiving it on a flat sheet of white paper from which all other light is excluded, a well-defined image of the object will be produced. Just how pin-hole photography got started, I do not know; but there appears to be some possibility that it was developed from the accidental performance of the experiment suggested above. It seems that some one lay abed in a darkened room until a rather late hour. The day was apparently a fine one; for the sunlight fell upon a cow grazing, was reflected to the outside of a window blind, where some of the rays found a tiny hole through which they passed and focussed themselves on the wall. Here the one in bed saw the upturned image of the grazing cow. As the image was made up of the equivalent of focal points, it was what the physicists call a real image. Of course, such a real image as this is precisely what the ordinary camera produces upon the sensitive plate or film. In fact, it is well known that, by closing the iris diaphragm down until only a minute point of the lens is exposed, very fine pictures may be taken with the ordinary camera. Under these circumstances, we really have pin-hole photography as the lens then plays only a very insignificant part.

Stereoscopic view made by means of two pin-holes, with the camera box divided by means of a partition

Pin-hole exposure of a woodland stream. This photograph required an exposure of one minute

One great reason for excellence with the pin-hole camera is the fact that we have definite focus over the whole field. The focus at a particular point *A*, for example, is not effected by changing the direction of diverging rays so as to make them converge. An entirely different principle is at work. A bundle of parallel rays—a beam—sets out from A^1 on the object, passes through the pin-hole and strikes the receiving surface at *A*. Beams from other points on the object than A^1 pass through the same hole but none fall at *A*. They take up positions relatively similar to those they had in the original object. There are beams from these other points which head for *A* but never reach it, being cut off by the opaque material surrounding the pin-hole. Consequently, the image made by beams is an equivalent to the usual real image.

The foregoing is exactly true only when the distances of object and image from the pin-hole are equal. When the distances differ the beams are no longer bundles of parallel rays but are elongated cones or pencils of rays. With this modification the preceding analysis may be accepted as correct.

A second great advantage of the pin-hole camera consists in the fact that focussing becomes unnecessary. There is, in fact, no focus to get. Probably, if the plane of the minute periphery of the hole and the plane of the receiving surface are out of parallel, more or less imperfection analogous to "bad focus" will ensue. The elimination of focussing adjustments is a great step in the direction of mechanical simplicity.

On the other hand, the necessity for a dark interior is just as great as ever. Similarly, it is just as essential to provide a thoroughly adequate means of

(*Continued on page 584*)

Add to the experience of the workman the high power of the microscope, and the hidden character of steel becomes an open book. The thread of weakness shown by this hundred-times enlarged photograph might have escaped any but the utmost vigilance. Such is the everlasting care which marks the Forging, Tool or Machine of Billings & Spencer.

A New Alphabet and a Typewriter for Chinese

THANKS to the work of Reverend E. G. Tewksbury, a missionary inventor and head of the China Sunday School Association, the tired Chinese business man is no longer obliged to turn out his correspondence by laboriously painting it with a brush. The rattle of the typewriter is beginning to be heard in the land of the lotus, despite the fact that only a short time ago the task of adapting a keyboard to Chinese was looked upon as hopeless.

Mr. Tewksbury achieved a Chinese typewriter by making use of the new phonetic script. The old system of writing, which involved thousands of separate characters, was manifestly too complicated for anything but a pot of ink, a brush, and a good memory. There were a few earlier attempts, however, to adapt it to the typewriter. Dr. D. Z. Sheffield of the American Board Mission invented a machine consisting of a wheel two and a half feet in diameter on the back of which were dies arranged in columns for the printing of 3,000 characters. The operator turned the wheel until the proper column came into place; then, by manipulating an arm underneath, brought the paper directly under the word desired.

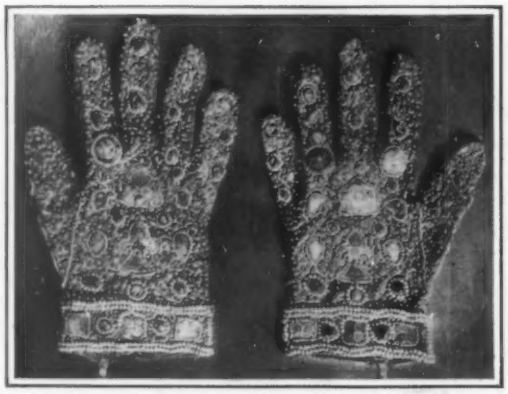
Another typewriter was evolved at the offices of the Commercial Press in Shanghai, the characters for which were made of printing type. The manipulator took hold of a movable arm, which picked up the type desired and carried it to the paper. By applying himself industriously, an able operator could thus finish today's correspondence as early as a week from next Saturday.

The phonetic script, however, which consists of thirty-nine symbols and thirteen punctuation marks, goes as well with a keyboard as a lotus flower does with a Chinese god. It is possible to adapt any standard make of typewriter to its use, a special machine being entirely unnecessary. Mr. Tewksbury experimented first with typewriters having a shuttle instead of type-bars. Blanks were secured from home and marked with the phonetic symbols by a Chinese engraver. As there are three rows of type on a shuttle, it is possible to have phonetic characters and Roman letters on the same typewriter—a great saving both to missionaries and to commercial houses who do business in two languages.

In using the symbols on machines of the type-bar variety, it was necessary to replace the Roman small letters with the phonetic symbols. Thus the same machine can write English figures and "cable type" as well as Chinese. One manufacturer is preparing a special set of typebars, containing Chinese symbols and English Gothic, which can be bought for a few dollars and replaced at home. In grouping the letters, an attempt was made to place the phonetics over the English letters that they most resemble in sound.

The fact that some of the Chinese sounds have no exact English counterparts made it impossible to carry out the plan in its entirety. Chinese characters are usually written down the column instead of from left to right. Mr. Tewksbury met this problem by setting the phonetic symbols sidewise, so that when the paper is taken from the typewriter and turned, the symbols appear in a column.

The use of the phonetic script is becoming so widespread in China that the whole course of the country's development promises to be affected. It was formerly a common saying that a Chinese never finishes learning to read. A man might spend practically all his life in study and yet run across characters which



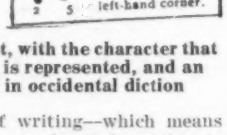
The jeweled coronation gloves of the Holy Roman Empire, which the Germans fear may be removed to some Allied capital

he is unable to decipher. The character for such a single word as "spoon" is so complicated that seventeen different strokes are required to produce it. Several years of a Chinese child's education must be given to learning the mere technique of writing—which means that the time available for consuming information is necessarily very much shortened. The result of this system is that China has 270,000,000 illiterates.

	Phonetic Symbols	Key Characters	Wade Rom'zn
INITIALS			
1	ㄍ	哥	KÈ
2	ㄎ	科	K'E
3	ㄫ	(我)	NG (O)
4	ㄐ	基	CHI
5	ㄑ	奇	CH'I
6	ㄕ	尼	NI
7	ㄉ	得	TÈ
8	ㄊ	特	T'È
9	ㄋ	訥	NÈ
10	ㄅ	撥	PÈ
11	ㄆ	坡	P'È
12	ㄇ	摸	MÈ
13	ㄈ	佛	FÈ
14	ㄌ	窩	(WO) V
15	ㄗ	姿	TZŬ
16	ㄘ	疵	T'ZŬ
17	ㄙ	私	SZ'Ŭ
18	ㄓ	之	CHIH
19	ㄔ	池	CH'IH
20	ㄕ	詩	SHIH
21	ㄏ	陰	HÈ
22	ㄒ	希	HSI
23	ㄌ	勒	LÈ
24	ㄖ	日	JIH

	Phonetic Symbols	Key Characters	Wade Rom'zn
MEDIALS			
25	ㄧ	衣	(Y) I
26	ㄨ	烏	(W)U
27	ㄩ	迂	(Y)Ü
FINALS			
28	ㄚ	阿	A
29	ㄛ	哦	O,È
30	ㄝ	耶	(Y)EH
31	ㄟ	危	(W)EI
32	ㄞ	哀	AI
33	ㄠ	熬	AO
34	ㄡ	歐	OU
35	ㄢ	安	AN
36	ㄤ	昂	ANG
37	ㄣ	恩	(Ê)N
38	ㄥ	哼	(Ê)NG
39	ㄦ	兒	ÊRH

Tone Chart. Dot at corner indicates tone as in chart. The first tone will be indicated by a short horizontal stroke under the lower left-hand corner.



The new Chinese phonetic script, with the character that tells the Chinese what sound is represented, and an approximation of this sound in occidental diction

The phonetic script, which was first introduced by the government, is now being taught in practically every mission school of northern and central China. Many Chinese Christians have pledged themselves to teach it to at least ten illiterates a year. It has been proved by constant experiment that one can learn to read by means of the script in less than a month.

The progressive governor of Shansi province recently ordered 5,000,000 copies of a phonetic primer for the use of his people. He has issued a mandate commanding every man under forty and every woman under twenty-five to learn the script by the first of March. By means of a phonetic newspaper published in his capital, thousands of people in the province are coming in touch with outside events for the first time.

The success of the Chinese typewriter has led printers to investigate the possible adaptation of the linotype machine. Hitherto a Chinese printing office contained more kinds of type than there are germs in Oriental drinking water. The printer stood in the center of trays containing 5,000 small boxes and patiently picked out the desired characters. When phonetics are used, however, the number of boxes is not more than sixty-five, counting even the figures and the thirteen punctuation marks recently endorsed by the Ministry of Education. There are really fewer kinds of type necessary than in an American print shop, as the phonetic script does not require capitals.

The adaptation of the lintotype machine will revolutionize the production of every kind of literature in China just as the invention of the typewriter promises to revolutionize business methods. In fact, there is a possibility that the thirty-nine symbols may awaken the greatest slumbering nation of the world, and do more to change international history than another war.—By *Elsie McCormick*.

Are Gloves Jewelry?

WHEN we meet in type or in conversation the good old expression "crown jewels," we ordinarily think of a sumptuous array of gems and jewelry. We visualize these wonderful stones as set in crowns and rings, bracelets and pendants, perhaps even in belts and breastplates and other survivals of barbarism—to say nothing of headdresses for the feminine contingent of royalty. And then there are scepters and other special appurtenances of a throne to be included in our conception of the crown jewels. But how many of us would ever suppose that gloves properly come within this category?

In connection with the problem of German reparations, however, the German newspapers are making a great hue and cry to the effect that the Allies are demanding the surrender of the crown jewels of the old Holy Roman Empire, which since their last public appearance back in the eighteenth century have been reposing in the treasure chamber of the Royal Palace in Vienna, former capital of the "Empire" that Napoleon terminated for good. And in connection with these outcries of an indignant "oppressed" nation, pictures are published showing some of the choice pieces which, by implication, the reader is invited to regard as destined for British museums and American multimillionaire mansions. Among these choice items is the pair of coronation gloves which we illustrate herewith, and which are supposed to have decorated the hands of Otto and his many successors on the ceremonious occasions of assuming title as head of the Holy Roman tradition. As we look at these ornate affairs, there can be no doubt that for once, at least, the question of the above headline must be answered affirmatively.

The left and center views show Chinese type-setting as it has always been done—a sort of Marathon performance. At the right we see the best typewriter that has heretofore been available for the traditional Chinese script.

Trials of the literate Chinese that ought soon to disappear with the invention of a new alphabet and a typewriter to write it

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

Copyright, A. N. Micnoff

Clumsy card players will find this automatic card-dealing device a boon

A Device That Deals Out Cards

CARD-players whose fingers are all thumbs will feel grateful to the French inventor who has brought out a simple, yet highly ingenious, device for the rapid dealing of playing cards. It consists, as will be noted by studying the illustration above, of a metal tray large enough to contain a full pack of cards, and a wheel with a rubber rim kept in contact with the topmost card by means of a spring. Connected to the wheel is a small chain to which is attached a wire terminating in a loop for the finger. Each time the wire is pulled, one card is dealt, the spring bringing the wheel into contact with the next card.

All well and good, to be sure; but what would be the effect of introducing this device before a group of seasoned card-players?—By *Ralph Howard.*

An Air-Hose Stand That Doesn't Get in the Way

A NEW air-hose stand has been introduced by a Wisconsin manufacturer which will keep the hose for supplying the air off the ground and out of the way of the easily aggravated pedestrian. It will also make filling tires a more likable sort of a job, for the questionable sport of trying to unravel about a mile of hose is done away with in the construction of the device.

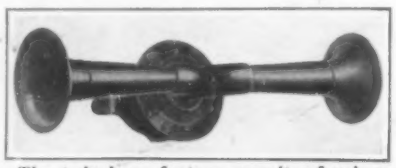
The stand is formed of a column of cast iron, which has a large door at the bottom, permitting the attachment of hose to the service pipe. A spring, which is especially wound to maintain a constant tension, is fitted to a sleeve which in turn fits on the top of the column and can be removed with ease. A ⅝-inch pipe extends from the top of the spring and carries eleven feet of air hose having a regular automatic air valve attached to the end. The height to the top of the pipe is ten feet.

This air-hose stand brings air to any tire without the usual inconvenience

The column is so formed that a water tap and hose may be installed as well as an electric light for night use. The device has an exceptionally long reach and may be carried easily while walking around the car.—By *Allen P. Child.*

A Factory Signal With Twin Horns

A NEW factory signal has a double projector, making it possible to locate signal in a passageway or corridor in order that it may be sounded in a line parallel with that of traffic. It is said this design of signal has a far-reaching tone unlike any other noise heard in industrial centers. It operates by electricity, the body being cast and tapped for conduit wiring. It is heard where the ordinary bell is missed. In some instances it is being used for special code signals.—By *K. H. Hamilton.*



The twin-horn feature permits of using this device in hallways and corridors

A Tractor That Walks Like a Horse

A NEW type of tractor that has recently been developed has a series of legs and walks like a horse. The machine is of the six-cylinder type but has no clutch. There are four crankshafts, each having a set of four legs, giving the tractor sixteen legs on which it walks. In addition there are four wheels automatically operated by the tractor engine, so that they can be lowered to the roadbed, thus converting the machine into a motor truck.

The feet are shod to conform to the ground conditions. A sharp chisel foot may be used to penetrate the soil to any desired depth, breaking up the plowpan and cupping it, allowing the moisture to settle into the cuppings, thus making it possible to produce larger crops; or a foot like that of a horse may be used on hard ground and in mowing grass or harvesting grain, or a foot may be used which is especially designed for soft, muddy ground.

The walking or propelling legs may be used to break up or puncture the subsoil to a greater or less degree, according to the work performed and the nature of the crop, or may be adjusted to take care of the proper pitch or working angles to suit different soil conditions, or adapted to side-hill work.

When the propelling legs are used for puncturing or breaking up the subsoil it aerates and fertilizes the subsoil and forms moisture-holding or retaining pockets, enabling a full crop of vegetation to be obtained with a greatly reduced rainfall.

When the machine is being used as a truck the propelling legs are raised clear from obstructions; but when it is found necessary to obtain great traction, these legs may be easily lowered and used in conjunction with the wheels, thus giving the machine a great advantage on muddy roads or in climbing hills. The machine will plow, seed, cultivate, harrow, mow and harvest, rake, furnish power for other machinery as a tractor and power plant and will also act as a truck for road work and heavy hauling. —By *R. F. Mundorff.*

Keeping the Elevator Tracks Greased

GREASE pots for smearing lubricating fluid on elevator shaftings to contribute to the comforts of the elevator boy in his continuous story of the "ups-and-downs" of life, can be discarded, without reluctance, if an invention of a Washington, D. C., citizen proves practical.

Simple of construction, the apparatus weighs less than two pounds. With the exception of the metal wheels which revolve when the elevator is in operation, the contrivance is constructed of aluminum, with a glass container for holding a pint of oil. Anyone who has observed the absorptive qualities of a lamp wick will readily know of the capacity of a wick, inserted in this pint oil-container, for conveying steadily drops of fluid directly to the elevator shafting. The lubricator eliminates the irksome job of smearing the grease on by hand as well as accomplishes the task in a more systematic and economical fashion. Even the elevator boy is not beyond the grasp of mechanical ingenuity!—By *S. R. Winters.*

Turning the Motorcycle into an Automobile

THE almost prohibitive cost of gasoline in Europe is reflected in the numerous attempts at light cars. Indeed, hardly a week goes by but that another dozen different types of gasoline-driven vehicles are introduced in Great Britain, France, Belgium and Germany, designed to carry passengers and cargo a maximum distance with a minimum gasoline consumption. The old cyclecar idea is again with us—it died here in the

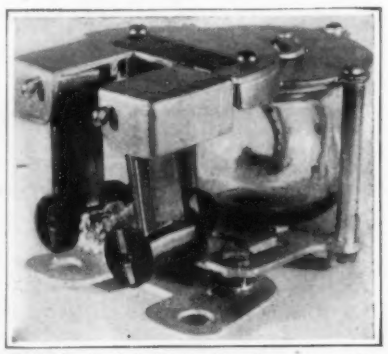
Sixteen legs propel this tractor

United States some seven years ago, after a glorious but vain fight to gain popularity, because of the prevailing rough roads at that time. Today, and particularly in Europe, the light car or cyclecar has a very definite and no doubt practical application.

One of the latest European light cars to come to our attention is the German creation shown in the accompanying illustration. This, it will be noted, is nothing more than an overgrown motorcycle, with a twin-cylinder engine driving the rear wheel through a belt. A body with two seats is added to camouflage the usual motorcycle construction and to give one the sense of security that goes with the automobile. Two auxiliary wheels, raised and lowered by a lever, serve to steady the vehicle when it slows down and comes to rest. Obviously, these wheels are raised when the vehicle is under way.

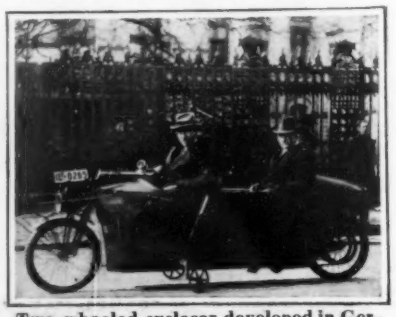
Recent Patent Decisions

Right to Make and Vend:—A man by the name of Alexander Ehmling conceived the thought of a letter stationery box which would make its appeal to purchasers through having certain features of convenience of use. One was to have the box so constructed that it would



This device lubricates the elevator tracks each time the elevator moves

answer the purpose of a writing desk. This was an important, if not the chief feature, and gave to the box the designation of a "desk box." Another feature was the division of a box into compartments, so that the lid, when opened, might hold the writing paper as a pad, and the body of it the envelopes, separated by a partition, which made the tray for holding pens. This required such a construction as would permit of the lid, with its pad of writing paper, folding down over the body containing the tray and envelope space. The attempt to build up a business met at first with poor success. The business was that of the "Twin Company." Alexander Ehmling was himself the chief salesman. As such he was quite successful. He was also president of the company. The box was not identified by the trade with his name, so as to be known as the "Ehmling Box," but was known under other trade names. Later on there was need to reorganize the business. This brought the present plaintiffs into it, and Ehmling, the patentee, dropped out. Then came the establishment of military camps, first on the Mexican border and later in a number of places. The sale of letter writing facilities, such as these boxes afforded, was greatly stimulated, and the business expanded eight fold. Soon a salesman of the plaintiffs, on visits to camps and to naval and military officers, who were purchasers of navy and army supplies, found there were competitors in what the plaintiff looked upon as their special field. Among these competitors was the defendant. The court held herein that the Ehmling patent is valid and infringed by the defendant. The doctrine of the law is that a patentee has such a monopoly and right to make and vend as the award of a patent makes effective. The grant of letters patent alone gives him the rights he claims. The patent granted is prima facie valid.—*Steele v. D. L. Ward Co. U. S. D. C. of Penna.*



Two-wheeled cyclecar developed in Germany to combat high cost of fuel

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Electrical Devices

WIRE CABLE.—J. W. PARTINGTON, 359 Paulison Ave., Passaic, N. J. The invention relates particularly to power carrying cables, and has for an object the provision of a construction wherein a maximum cross sectional area is provided in a minimum space. Another object is to provide a cable with a central wire and square wires wound thereon, the respective wires being wound in the opposite direction, the wires square in cross section forming the outer layer and an insulating coating thereon engaging one of the flat sides of the respective wires.

LAMP AND REFLECTOR HOLDER FOR FLASH LIGHTS.—H. M. KORETZKY, 310 Hudson St., New York, N. Y. A specific object of the invention is to provide a lamp reflector holder which includes a metal disk having means for attaching the reflector thereto, and with which the movable contact of the switch is adapted to connect, there being means for attaching the reflector to the disk and insulated therefrom, and also means carried by the dish but insulated therefrom for forming a protector for the lamp against the action of the weight of the battery, the protector serving as a connection with the contact of the lamp.

LAMP.—C. LAFITTE, 857 Forest Ave., Bronx, N. Y. This invention relates to a framework for a lamp, and aims to provide a device which shall be capable of being utilized as a bed light or which may be shaded so as to provide a night light, and which may be adaptable to the application of an ornamental figure to its framework so that the finished product may present a lamp which is highly ornamental, different globes may be readily substituted.

Of Interest to Farmers

PLOW.—S. J. COATNEY, 726 2d St., Santa Rosa, Cal. The invention relates particularly to wheeled plows in which provision is made for raising and lowering the plow. An object is to provide a simple plow elevating mechanism which includes a one piece axle so formed as to effect the raising and lowering of a plow by one operating lever and without disturbing the position of the plow frame, so that irrespective of the vertical adjustment of the plow, the frame maintains its normal level.

SOIL BREAKING AND PULVERIZING MACHINE.—L. A. GREENE, Greenville, S. C. The object of the invention is to provide a pulverizing machine to be drawn over the field by motive force, and having a plurality of cultivating implements attached, one of which, in addition to its action in breaking and pulverizing the soil, acts also as a drag to control the depth of the cutting of the implements, and wherein in addition to their action in breaking and cultivating the soil, they act also to propel the machine.

Of General Interest

DUPLEX ENVELOP.—J. J. DORGAN and M. J. SULLIVAN, P. O. Box 197, Holyoke, Mass. Among the principal objects of the invention are to provide an envelop with compartments proportioned to the uses for which they are intended, to reduce the cost of material employed, and to facilitate the handling of the envelops by the postal authorities.

RULER.—W. W. EATON, 59 Linden St., Bayonne, N. J. An object of the invention is to provide a ruler with a longitudinal space thereon which is adapted to receive numerals registering with the scales, which numerals can afterward be erased or otherwise removed. A further object is to make provision on the ruler so that the division marks may be numbered, according to the needs of the user at the moment, and afterward removed.

PAVING BLOCK.—M. P. KEALY, 91 Mill Rd., Jersey City, N. J. The primary object of the invention is to provide means by which the wood blocks are spaced with relation to each other, said means also serving to maintain the blocks in their proper position during the operation of laying the pavement. A further object is to space the blocks the necessary distance to permit of the insert of a grout or other suitable material, for preventing the road surface becoming slippery in wet weather.

INSOLE.—J. BERGSTEN, 1324 Edwards Ave., Bronx, N. Y. The object of the invention is to provide an insole to be inserted in shoes, and other footwear, and arranged to keep the feet of the user warm and dry. Another object is to provide an insole which is naturally resilient, thus insuring easy walking. Another object is to utilize the heretofore wasted bark of the balsa tree in the formation of the insole.

Hardware and Tools

NUT LOCK.—W. R. and R. O. KILPATRICK, care Merchants' Hotel, Grafton, N. Dak. The object of the invention is to provide a nut lock which will lock the nut in any position of angularity with respect to the bolt, never requiring that the nut be turned too tightly or too loosely to bring it in proper position for the lock to function.

WRENCH.—J. ROBUS and C. D. COMPTON, 416 W. 124th St., New York, N. Y. This invention relates more particularly to a device peculiarly adapted for use in connection with toggle bolts and which will greatly facilitate their application to their applied position. A further object is to provide a wrench of the socket type which will readily engage the means used to retain a toggle bolt in applied position, so that the fastening of the bolt to a wall is a comparatively easy matter.

SOLDERING IRON.—E. T. MAHAN, Ardmore, Pa. An object of the invention is to provide a soldering iron having a combustion chamber in which gas and air of any desired pressure, either high or low, can be burned to efficiently heat the iron. A further object is to provide a construction which can be readily assembled or taken apart and which most efficiently performs the functions for which it is intended.

WIRE TWISTER.—P. MACD. BURNS, 255 Mississippi St., San Francisco, Cal. The invention relates to devices for twisting ends of wire together and more particularly to a tool for connecting the ends of tie wires on bales, boxes, and other packages. The principal object is to provide a simple wire twisting tool with efficient ratchet mechanism, which will rapidly connect the ends of tie wires by comparatively few operations of a lever.

Machines and Mechanical Devices

MIXING DEVICE WITH INDEPENDENTLY ADJUSTABLE STIRRING-ROD.—M. BLACK, 390 Putnam Ave., Bronx, N. Y. This invention relates more particularly to a mixer adapted to be manually operated. An object is to provide in a stirring device either for manual or motor operation, a construction which will permit the stirring member to be raised or moved independently without moving the driving mechanism therewith, and to provide means for holding the stirring rod in properly adjusted position.

SKATING SCREEN.—C. E. GRISWOLD, Box 813, Globe, Ariz. This invention relates more particularly to a screen for use in connection with ore, coal and other material of a nature which subjects the screen to heavy severe usage, the prime object being the provision of a construction which will be simple, strong and durable, and which will operate with maximum effectiveness and efficiency as well as with great increased speed of action as compared to other machines of this type.

METHOD OF MAKING STEREOTYPE MATRICES.—C. WINKLER, Berne, Switzerland. The invention relates to a method by which the press is not stopped for drying the matrix until the press-head, or the like, has passed, or retreated from, the point of highest pressure. Thus the pressure on the matrices is released or reduced just after maximum pressure. A matrix is thus adapted to be formed by exerting maximum pressure to imprint the same and then subjecting the matrix to a somewhat lower pressure while it is drying.

AUTOMATIC GRINDER STONE DRESSER.—F. E. RILEY, Livermore Falls, Me. An object of the invention is to provide specially constructed valves and operating means therefor of an automatic nature whereby the continual to and fro reciprocation of the main carriage and a similar forward and rearward movement of the cross feed motor may be accomplished in a smoother and more satisfactory manner. A further object is to provide a safer hand feed screw for controlling the depth of cut of the bur or reciprocation of the cross feed motor.

Medical Devices

ARTIFICIAL TEETH.—I. M. HAIR, Spartanburg, S. C. The invention relates more particularly to means for securing the teeth facings in connection with backing members for use principally in bridge work. The invention aims to provide an active lock cooperating with the tooth facing and one or more pins cemented therein, so that a strong permanent union is effected even where the tooth facing is so thin as to render the usual connection ineffective.

Prime Movers and Their Accessories

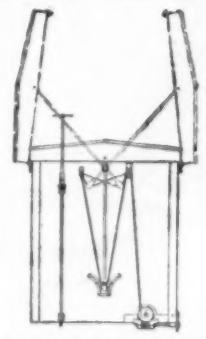
PROTECTING DEVICE FOR STEAM-TURBINE BLADES.—H. C. JOHNSON and E. H. PERCY, Fort Bragg, Cal. The invention relates generally to steam turbines, and more particularly to protecting means for the blades at the low pressure end of the bladed cylinder, the object being the provision of a protecting device capable of effective use without detracting from the power and efficiency of the turbine as ordinarily utilized.

LUBRICATOR.—P. B. SAMPLE, care Paymaster, U. S. S., "Delaware," New York, N. Y. The invention relates to oilers and lubricators, and more particularly to a lubricator especially designed to inject graphite, powdered soap stone, talcum or other similar lubricating substances to manifolds, crank cases and cylinders of internal combustion motors, and particularly gas engines. The device may be adjusted to feed lubricants in regulated quantities.

GEAR.—W. C. SWEAT, Box 163, Everett, Wash. One of the objects of the invention is to cause the driven shaft to travel at the same rate of speed whether it is being driven in one direction or its direction reversed. A further object is to provide a transmission gearing wherein all the gears are of a uniform diameter and therefore all gears will travel at practically the same speed, having less tendency to heat in operation.

Railways and Their Accessories

FREIGHT CAR.—M. CHRISTOPHERSON, 330 58th St., Brooklyn, N. Y. An object of the invention is to provide a car of the box car type having a movable roof which can be hinged to



A VIEW IN END ELEVATION

either side of the car so as to expose the load and permit the same to be removed by means of a derrick or other suitable mechanism through the top of the car.

AUTOMATIC RAILWAY CAR DOOR.—W. N. MCCLELLAN, 430 Cumberland St., Brooklyn, N. Y. Among the objects of the invention is to provide means acting automatically between the station platform or the mechanism beneath the platform and the car mechanism to cause the doors to open automatically coincidentally with the stopping of the car at the station, and to provide means under the control of the station agent or guard to prevent the motorman from shutting the doors and starting the car prematurely.

WHEEL.—G. YATES, 3215 Carnegie Ave., Cleveland, Ohio. This invention has for its object to provide in wheels for railway cars a construction wherein roller bearings are arranged between the wheels and the axle, or between the axle and the journal box and wherein the wheels are rigidly connected. Should a roller break, or the bearing be otherwise damaged, there can be no trouble from this cause, since the axle can still rotate freely in the journal boxes.

Pertaining to Recreation

AMUSEMENT DEVICES.—F. J. GIBSON, 4041 39th Ave., Oakland, Cal. The invention relates to amusement devices, and more particularly to means for imparting an up-and-down movement to a circular series of passenger carrying devices, the latter being preferably in the form of airships. A further object is to provide means for supporting a circular series of airships and means for imparting a motion to them causing them to move horizontally in a circular path.

TOY.—J. V. HAMILTON, Jr., Fort Scott, Kans. The invention has for its object to provide a toy of the vehicle type, designed to simulate in figure an automobile, and to be so arranged that one seated in the vehicle may propel the same with the feet, and may guide the vehicle with the hands with a steering wheel.

Pertaining to Vehicles

VEHICLE WHEEL.—H. D. REY, Avarua, Island of Rarotonga, Cooks Island, New Zealand. The object of the invention is to provide mechanism for permitting pneumatic tires to be easily and quickly attached to or detached from the wheel, and for seating the abutting edges of the shoe to provide a closed tube that may be inflated directly without the use of an inner tube, wherein a form of tire is provided having the usual holding ribs and having an extension from one side edge to about the other side edge to permit the edges to be seated. The shoes having wired or reinforced beads may be adapted for clencher type tires.

ATTACHMENT MEANS FOR RECEPTACLE COVERS.—T. HILL, 1135 Park Ave., New York, N. Y. The invention relates particularly to removable caps for automobile radiators. Among the objects is to provide a permanent connection between a radiator cap and the radiator, the connection providing for the usual manipulation of the cap, but preventing loss thereof, or removal by any means upon the application of special tools.

RUNNING GEAR FOR WAGONS.—A. and J. CHAMBERLAIN, care P. A. Sullivan, Wynot, Neb. This invention relates to the circle and hounds of a wagon running gear, and the general object is to provide a construction in which the elements forming the hounds are returned to a connection with the axle and so positioned as to constitute a pocket for receiving the wagon tongue.

AIR COMPRESSOR.—A. B. PEDERSEN, Box 356, Eureka, Utah. The object of this invention is to provide a device especially adapted for inflating the tires of motor vehicles wherein the compressor has a high and a low pressure side, the air compressed by the low pressure side passing freely through the high pressure side so that the high pressure side does not begin to compress until the pressure in the tire attains a predetermined point.

Designs

DESIGN FOR AN ARTICLE OF MANUFACTURE.—M. OESTREICHER, 129 Ave. C, New York, N. Y. This inventor has been granted two patents on designs for table covers, sofa cushions, or the like.

DESIGN FOR AN AUTOMOBILE.—C. T. SILVER, 100 W. 57th St., New York, N. Y. This inventor has been granted patents on two ornamental designs for automobiles.

DESIGN FOR A DISPLAY SHELF SUPPORT.—H. J. NUTRIZIO, 145 Duane St., New York, N. Y.

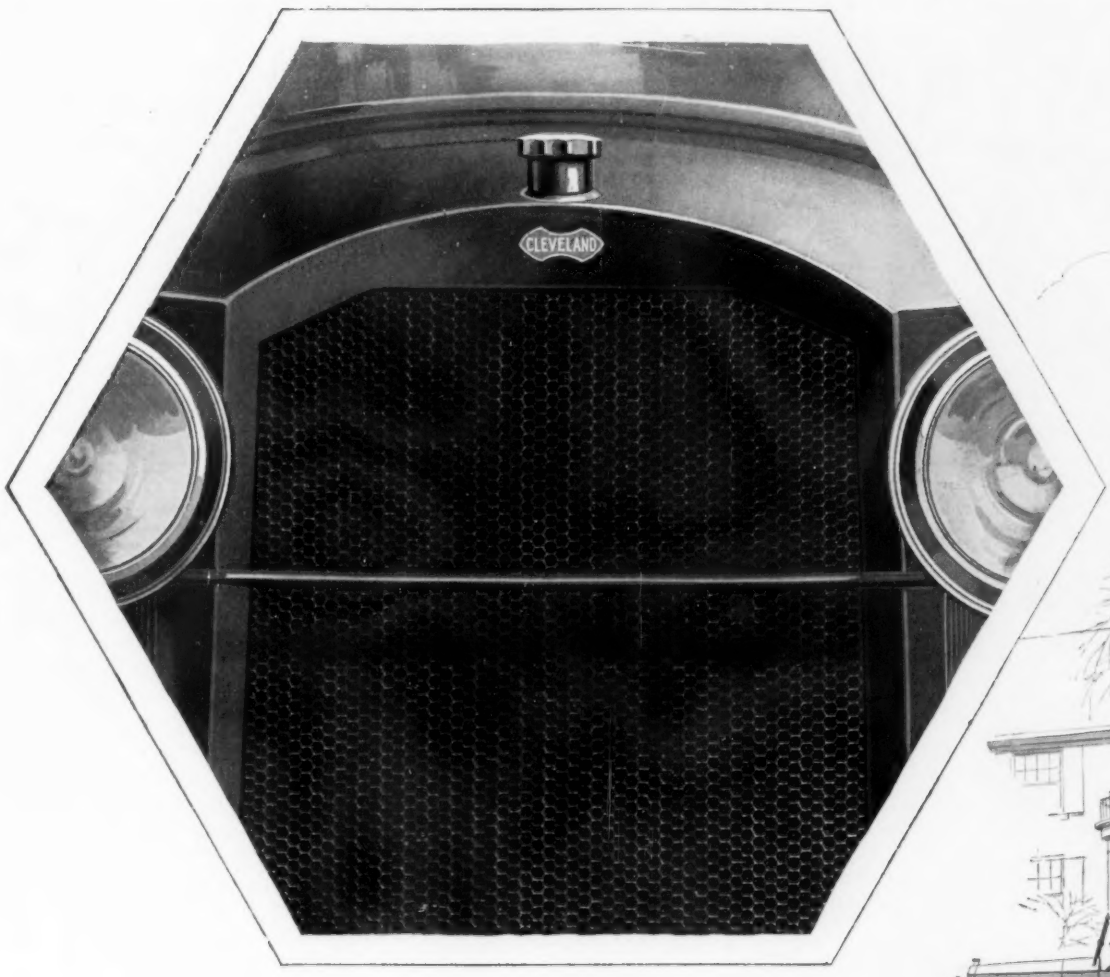
DESIGN FOR A CONTAINER FOR TOILET POWDER OR OTHER COMMODITIES.—C. S. HUMPHREY, care Manhattan Can Co., Bush Terminal Bldg., No. 10, Brooklyn, N. Y.

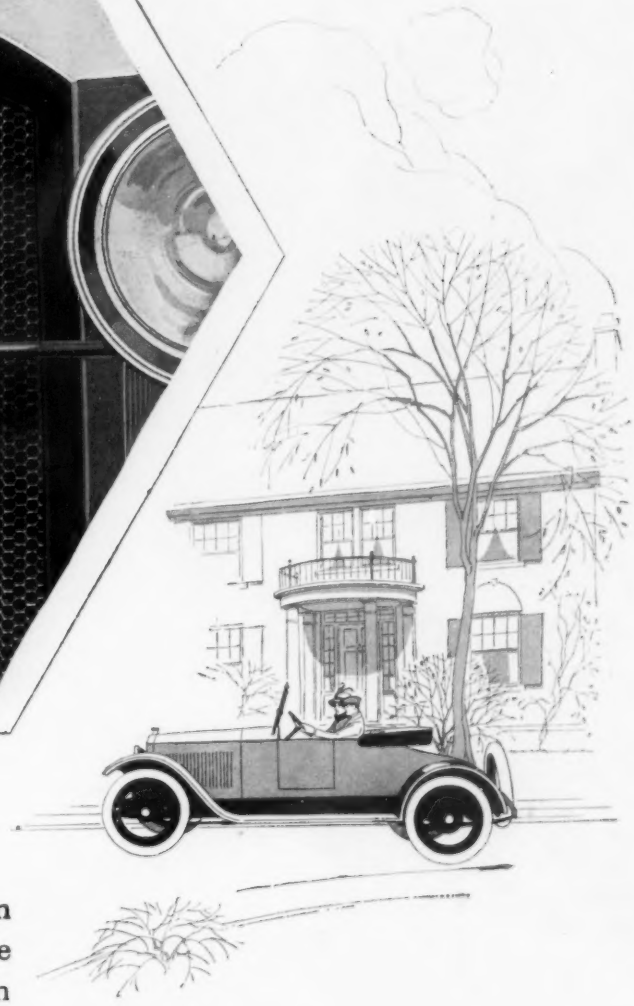
DESIGN FOR A TIRE.—F. W. SMITH, 183 Washington Ave., Rutherford, N. J.

DESIGN FOR A RING.—S. and H. GILSEY, Wiggans Block, Cincinnati, Ohio. These inventors have been granted patents on two designs.

DESIGN FOR A PNEUMATIC METAL WHEEL.—H. E. and P. R. SIMMONS, P. O. Box 103, care Caswell Runyan Co., Huntington, Ind.

DESIGN FOR A CASING FOR INDICATORS, SUCH AS CLOCKS, BAROMETERS, OR THE LIKE.—M. WEIWODA, 826 Boulevard, Bayone, N. J.





The merit of any product is best proven by the service it renders. The service record of Harrison Radiators is known the world over. The many universally known motor cars which are Harrison equipped have effectively demonstrated the uniform high quality of Harrison performance. The Cleveland is another Harrison equipped motor car.

HARRISON RADIATOR CORPORATION
General Offices and Factory: Lockport, N. Y.
General Sales Offices: Detroit, Michigan

HARRISON *Original Hexagon Cellular* **Radiators**

The Crop Factory

(Continued from page 563)

height excavated, measured from the foot of the glass, is 5 meters. Walls and bottoms are of reinforced concrete and perfectly water-tight. Built in the wall at the periphery and supported on twelve pillars near the center, a thick reinforced floor, containing steam-heating pipes, divides the height.

The space underneath is reserved for storing loam, crops and the paraphernalia of a modern nursery. The upper part, absolutely water-tight, receives a covering of elevated, finely perforated, porous bricks dipping in a sheet of water kept at a constant level five centimeters thick, a space of 20 centimeters remaining between the face of the water and the underneath part of the brick.

On top of these bricks a layer of 60 centimeters of *manufactured* loam is evenly distributed. In the center a vertical tube, the top end of which is at about 20 centimeters from the glass surface, fits its bottom end in the covering of a well containing a reserve of water. The normal air is sucked through a special marine ventilator and forced by means of an electrical fan through a purifier where seeds, insects, dust, spores, etc., are retained. Thence it is forced through a washing column where the cleaning process is completed. From the washer it flows through the exchanger, where it picks up the heat of the exhaust and is then distributed through a main pipe running round under the loam floor ventilating the under room, while adducting tubes passing through the floor feed the air space underneath the bricks. Small steam jets are inserted in these adducting tubes. From this space the air containing about 90 per cent of moisture percolates through the loam and prevents its settling, as well as gives the plants the necessary moisture and ventilation. Having done its duty the air is sucked down the center vertical pipe are forced through the exchanger, where it delivers its heat and flows outside. Heat and moisture are thus constant. Sunlight is, when needed, supplemented by electric light—another constant.

In order to obtain the highest efficiency of the loam no footpaths are allowed. The work is entirely done from a revolving bridge bearing on the center and at the periphery, and adjustable to the height of the crops. Tilling, watering, weeding and ventilating being thus reduced to an infinitesimal proportion, the writer estimates at 70 per cent the reduction of manual labor needed to grow vegetables.

Open-Air Mining of Coal by Electric Shovels

(Continued from page 567)

mounted on caterpillar trucks which lay their own track like the tanks used in the war.

A third and very interesting view shows the face of the coal, and the cut from which the coal has been taken and loaded in the cars that run on the track on the edge of the top of the coal. In the far distance appears the shovel, and to the left of it the coal car. There will also be noted the conductor cables for transmitting the electric current to the shovel.

After the coal is dumped into the dump chute, it is fed on the picking tables. These are endless traveling metallic aprons moving at a speed of about 50 feet per minute. The coal is fed from the hopper on to these aprons continuously, where the tipple men pick out all impurities. The coal is finally discharged on the shaker screens which size it and load it simultaneously in three cars. In the first or outside car, is loaded the 4-inch lump; in the second, the 4-inch egg coal; and in the third or inside car, are the 2-inch screenings.

This process of mining is all done in the open daylight, in places where the coal seams are within 40 feet of the surface of the ground.

Dismantling a City

(Continued from page 566)

suggested that wherever these camps are within commuting range of large cities some civic action be taken to rebuild them into towns.

All of these camps have installed and ready for use complete water and electric plants, sewage systems and streets. If the buildings were converted into residences on the spot not only would an enormous saving be effected, but housing facilities would be quickly provided for from 20,000 to 50,000 people. It is believed this plan would be particularly effective in the case of New York City, where a large exodus to the country has already been noted due to crowded conditions in the city. Most of the army camps near New York are within an hour's ride of Manhattan and could be converted into towns with a minimum of expense.

The more isolated camps might be utilized in a similar manner by large industries, who now face an acute problem in the housing of their employees in the great industrial centers.

The Welded Joint in Structural-Steel Work

(Continued from page 567)

tons on the two trusses. The load consisted of gravel in bags which were piled in tiers on planking arranged for the purpose. Readings were taken at different increments of the loadings for the deflection in the truss members, and it was made evident that electric welding is a dependable method of uniting structure members and is stiffer than riveting if the work is properly performed.

It is particularly interesting to note that this test was actually carried to the limit of elasticity of the metal used. There is little doubt that this successful demonstration will go to further the use of electric welding in steel construction work. The many specific advantages are too important to be disregarded by engineers and contractors, particularly in these days when there is a vital demand for increased housing facilities for homes as well as for industries. The very fact that this test was witnessed by members for all building departments in Greater New York, and as a result a permit was issued for the erection of the building, should be sufficiently convincing to the skeptical that electric welding as a means of construction is not an unknown quantity.

The Laboratory in Business

(Continued from page 570)

woman, working with Mr. Coolidge's X-ray tubes which have made the X-ray what it is today, or experimenting in some intricate sort of wireless telegraph or telephone operation. He might see a room full of racks containing hundreds of incandescent lamps all being tested, from the tiniest "bug light" such as is used in hand flash lamps up to the most powerful incandescent known, made to replace the arc light in moving picture projectors.

In another long room the visitor may see rows and rows of tubular furnaces in which tungsten oxide is reduced to metallic tungsten in powder form at a temperature of about 1,000 degrees Fahrenheit, and prepared for the hydraulic presses from which it goes through battering, noisy swaging hammers and is eventually drawn out into the slenderest of wire filaments for lamps.

He might glance in at another door, perceiving a peculiar collection of tubes and bottles attached to a small cylindrical device. This is the famed Langmuir condensation pump which, by heating mercury and passing the vapor across the

(Continued on page 584)

Kelly Caterpillars enabled 5-ton truck to haul 16-ton load over mountains

"It was extraordinary," writes Mr. C. H. Hemme of San Diego, owner of the truck, "to see the rubber of the Kelly-Springfield Caterpillar tire spread itself from underneath the weight of the load and assume its normal shape again when released. We firmly believe that only the Caterpillar tire, allowing the rubber to spread in several directions, saved the day, as no other tire would have stood the extreme overload without coming loose from the steel. For heavy-duty service there is no tire that gives me more satisfaction than the Kelly-Springfield Caterpillar tire."

We don't recommend overloading a truck. It is bad for the truck and bad for the tires. But there are times when overloading is necessary, and when that time comes it is a great satisfaction to know that your tires can haul any load the truck can bear.

KELLY-SPRINGFIELD TIRE CO.

New York, N. Y.

The Laboratory in Business

(Continued from page 582)

mouth of the container to be exhausted, draws the air out of the container, producing the most nearly perfect vacuum known. This high vacuum has made the X-ray tubes and wireless sets far more efficient than they ever were before.

In recent years not only has this laboratory developed ductile tungsten for every sort of incandescent lamp and argon gas for making the larger lamps twice as efficient; it has done far more for industry. It has made the rectifier by which any owner of an electric automobile may charge his own batteries by hitching up the electric light socket in his own garage. It has chromized steel, making that and other metals almost rustless, and calorized them, making them usable in tremendous heat. It has produced a self-lubricating bearing and a water japan which can be made without fear of explosion and which wears at least as well as japans heretofore used. It has produced the magnetite arc lamp which has displaced all other types of arcs.

It has made wireless telephony possible by producing the pliotron, a radio tube of tremendous efficiency. Highest powered searchlights have come into use only by this laboratory's search-light electrode. Its many molded compounds and its insulating varnishes have improved and cheapened many kinds of electrical machinery. Its platinum substitutes and other alloys have saved money and relieved the stringency in platinum besides improving various devices. Its sheath wire has bettered heating devices and its development of tungsten uses has made better and cheaper ignition contacts for automobiles.

The workers in the laboratory are by no means limited to investigations which have immediate profit for their goal. In science, as in exploration, it is seldom the pioneers that reap the reward; it is those who come after, and develop the resources of the new lands that the pioneers have revealed. But it is only through pioneering that new lands can be discovered for development, and the laboratory feels that it should do its share in the pioneer work of pure science which is pushing forward the boundaries of knowledge and opening new fields for development by applied science and engineering.

Consequently we find one group surrounded by complicated apparatus, peering into the constitution of matter by means of X-rays; another, with vacuum tubes, pumps, and gages, studying the nature of chemical reactions at very low pressure—a billionth of an atmosphere or less; another attempting the development of a new method of chemical analysis. None of these studies promises any immediate practical result, but each will broaden the foundation of scientific knowledge upon which the applied science of the future must build. The results of dozens of such investigations have been published by the laboratory for the direct benefit of the world of science and the indirect benefit of all mankind.

Pioneering thus in the unknown or little known is absorbing work for scientists and experimenters. Once they, too, held aloof from the "taint of commercialism" and clove steadfastly to "pure" science even if they starved in the effort. Today, seeing the immense service they can perform in coöperation with industry, they have forgotten old-time prejudices, and laboratories such as the one at Schenectady are magnets for trained men who have come from far and wide. They are scientists but hardly of the long-haired type. Rather they are the sort of men one sees about the offices of any big business organization.

Ohio's Flood Insurance

(Continued from page 572)

two ridges of earth are raised, with steam shovels, marking the width of the dam. Mud is pumped to the crests of these ridges and allowed to flow to the hollow between. The stones and heavy material are deposited along the outer edge of the dam, and the silt is carried to a pool in the center. When the silt settles the water is drawn off.

As the dam rises the coarse material deposited along the outside forms "shoulders" of great strength, while the center core of silt is impenetrable to water. Engineers connected with the project believe they thus secure an ideal dam structure at a minimum cost.

Thus the system also makes it possible to use the earthen material at hand. The usual method employed is to wash down hillsides hydraulically, into big "hog boxes," where the mud is mixed, and from which it is pumped to the dam.

A great quantity of power is required, and this is supplied to all of the damsites from a central station large enough to care for the electrical needs of a good-sized city.

The project also includes the widening and straightening of all of the river channels and the building of many miles of protective dykes.

Pin-Hole Photography

(Continued from page 574)

protecting the film or plate against light before and after exposure. But these are among the things which may be provided at inconsiderable expense by purchase or home manufacture or which may be cared for by going to extra trouble. Thus, if the camera itself is dark, one may set the plate or film in position in a dark room, make a single exposure later on, and then remove the film or plate in the dark room. Naturally, this procedure cuts down the possible output. However, there are such things as film holders and plate holders, which may be bought. These may be rigged with the home-made camera.

I will now add some of the further advantages which enthusiasts mention. The Rev. J. B. Thomson (apparently a Scottish clergyman) says with respect to the *truthfulness* of the pin-hole method: "The first excellence of lensless photography which we would specify is its preëminent truthfulness. In this respect, no known image-forming device can compare with the needle-hole. In its action the light passing through the little aperture is literally rectigraphic. No lens we know, however composed or corrected, is absolutely rectilinear under all tests. The needle-hole *is*. Rightly used, it renders the lineaments of objects with geometrical accuracy, exactly as perfect human vision perceives them." This is high praise, but it is probably not too high.

As to *width of angle*, the pin-hole substitute for the lens will, it is claimed, include a much wider angle than the ordinary photographic lens. The wide-angle lens is hardly up to this.

Equality of effect is a very desirable quality claimed for pin-hole photography. With proper care in making and using the camera, the pictures should possess substantially the same definition everywhere.

As to general *quality*, again I quote Mr. Thomson: "It is of course known to all that a picture of a sort can be got through a needle-hole. But the general impression seems to be that the effect obtained is at best but a blurred or fuzzy suggestion of a photograph. This is a very mistaken notion indeed. On the contrary, the needle-hole will give pictures that not only fulfil the technical requirements of a good photograph, but have distinct artistic qualities of their own." He admits that the hard and sharp definition obtainable with certain lenses is not secured. Where such definition is desired or required, the lens must be used. "On the other hand, the needle-hole will give

(Continued on page 586)

Pin-Hole Photography

(Continued from page 584)

a moderately vigorous definition, and it will give that in alliance with qualities which are esthetically valuable."

He points out objections to excessive sharpness of definition, claiming for one thing that nature does not bestow that excessive sharpness which some photographers seek to obtain. Such sharpness of lines is foreign to the appearance of natural objects. There is in nature a softness which photographers should seek to reproduce. The pin-hole camera is a splendid means for accomplishing this. Here, the art branches—there is the highly focussed picture on the one hand and the soft, natural reproduction on the other.

Depth is related to definition. It may be said at once that pin-hole photographs may be made with very considerable depth. Depth is more or less dependent, let us say, upon getting the sides of objects in the picture. If so, this requires good definition; but it also requires good definition everywhere. Otherwise, the depth of the picture would not be distributed over its surface. "We have atmosphere and right impression of distance" with the pin-hole photograph. "By the softening down of detail, the really important lines and characteristic masses retain their natural prominence. And, what is still more important, we have what we may call *plastic quality*—that quality which makes objects stand out bodily and not merely appear on the flat."

Mr. H. W Barker of Toronto, to whom we owe credit for the pin-hole photographs herewith produced, finds in the long exposures a certain advantage. Objects moving back and forth in the scene fail of reproduction, and so do not mar the picture. "It is impossible, as we all know, to take a picture along one of our busy streets with an ordinary camera and not show the traffic, but a photograph taken with this box (a home-made pin-hole camera) shows a clear street every time." But, while snap shots are not taken with this contrivance, one must not get the idea that only excessively long exposures are permissible. This is by no means the case. The interior of the church was obtained by an eight-hour exposure. On the other hand, the view in the woods in Don Valley, near Toronto, required only one minute.

It is not the purpose of the present article to set forth directions for the making of a camera. The reader may apply to his book-seller to secure for him printed material on this phase. At the same time, a few words, in addition to those already given, may be welcome.

If the reader wishes a pin-hole camera and already possesses an ordinary machine, he has only to substitute the pin-hole for the lens and the job is done. But Mr. Thomson, who himself attained great excellence in actual experience with this style of photography, says that the ordinary camera limits the application of pin-hole methods. It is, on the whole, best to construct the apparatus. In the front of the light-proof box, four holes are bored, each 3/8 inch in diameter. One is exactly opposite the geometrical center of the plate; one is set an inch or so above the center hole; and the remaining two are placed 3¼ inches apart, at the same level as the central hole and one to either side symmetrically. These two holes are for the purpose of securing stereoscopic views. The center hole is for general purposes. The upper hole provides for views at a distance and has the effect of cutting off the foreground. Of course, these four holes are not the pin-holes; but they mark their locations. On the inside, the holes are countersunk until only a very thin piece of wood contains the original bore. The object is to provide for the crossing of the beams or pencils of rays. Sliding shutters may very properly be used. Thus, a sliding shutter may be arranged so as to command the central hole and the pair of stereoscopic ones. Another may be fitted in place for the upper hole.

The pin-hole is to be made in a suitable thin metal. Copper or soft brass, if secured thin enough, are very suitable. The hole is to be no larger than, say, 1/60 or 1/80 inch in diameter. A spot may be thinned and the hole put through.

Too much attention can hardly be given to preparing the pierced bits of brass or copper. It is very necessary that the hole be exceedingly short—hence the thinness. It is also important that it be perfect in shape and that there be at the finish no burr or roughness. Various sizes of holes may be used, just as various lenses are employed in ordinary photography. With these different sizes differences in results are obtained. The reduction of the size means, other things remaining the same, a reduction in the width of the angle of view.

Laws of Air Resistance of Aerofoils

A RECENTLY published report of the National Advisory Committee for Aeronautics has been written for the purpose of giving a general survey of the present state of knowledge about the laws of air resistance of aerofoils.

After a summary of the history of the subject and of the bases of the present-day treatment of the phenomena of fluid resistance, given in the introduction, the report starts by a critical discussion of the fundamental concepts used to describe the fluid resistance properties of aerofoils. Thus are successively examined the concepts of angle of attack, center of pressure, aerofoil area, metacenter, metacentric curve, zero lift line and resultant air resistance. First is examined the question of the apparent flow deflection produced by an aerofoil, preceded by a preliminary on the general property of vortices; the tip vortices are investigated; a general account of the intensity and direction of these vortices is given. Finally the edge vortices are studied and a general account of their properties is given including the main qualitative relations that hold for these vortices. The possibility of formation behind an aerofoil of two waves, called the primary and secondary waves, is examined and numerical values of the order of their magnitude are given.

In a set of Notes added to the report the following questions are examined: The Kutta theorem; the generalization of the Bernouilli theorem; the equations of the metacentric curves; translation of the paper of Th. v. Karman and H. Rubach on the Mechanism of Fluid Resistance.

A copy of this report may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

A Light-Fringe Dilatometer

SCIENTIFIC Paper No. 365, a new publication of the Bureau of Standards, describes a dilatometer for measuring small differential thermal or other changes in length by means of the change in width of the interference fringes. The principal practical feature of the method is that the sample is one small pin easily prepared. The method gives results as accurate as the previously used standard Fizeau-Pulfrich method while it is, in many cases, more convenient and direct and possesses several other advantages.

The instrument has actually been used at the Bureau of Standards for some time in determining thermal expansion. It is thought that it would also be applicable to the measurement of small length changes due to loss of moisture, magnetization, mechanical stress, etc.

This paper is now ready for distribution and any one interested may obtain a copy by addressing a request to this Bureau.

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NEW BOOKS, Etc.

THE CONDENSED CHEMICAL DICTIONARY. Compiled and edited by the Editorial Staff of the Chemical Engineering Catalog. New York: The Chemical Catalog Company, Inc., 1919. 8vo.; 525 pp.

Chemistry has of late made such a benevolent invasion of industry that interest in the subject now extends to firms and individuals of the most varying and diverse activities, and the need for detailed information concerning chemical products is acute. This new Dictionary is a splendid response to the lay call for help. A library in itself, it alphabetically lists nearly all the commercial substances, describes their properties and uses, gives derivation, habitat, grades, containers, fire hazards and shipping regulations and tells briefly show the manufactured products are produced. While intended primarily for the buyers, brokers, sellers and users of such products, the chemist will also find in it a time-saving reference book of no light value.

CAESAR'S COMMENTARIES ON THE GALLIC WAR. Literally translated. New York: The Translation Publishing Company. 16mo.; 301 pp.

The student will find the proper use of this careful literal translation, in connection with the original text, to be a distinct aid to a clear understanding and appreciation of the latter. The reader who aspires to some knowledge of the classics, but who has not the requisite knowledge to enable him to read the originals with facility, may also turn with pleasure and profit to this and similar issues of the "Students' Literal Translation" series.

IRON AND STEEL. By Erik Oberg and Franklin D. Jones. New York: The Industrial Press, 1918. 8vo.; 328 pp.; illustrated.

Two thoroughly competent writers, in collaboration with prominent metallurgists and steel-makers, have given us in "Iron and Steel" a valuable treatise on the smelting, refining and mechanical processes of the industry, including the chemical and physical characteristics of wrought iron, carbon, high-speed and alloy steels cast iron and steel castings, and the application of these materials in machine and tool construction. The text is peculiarly adapted to the requirements of technical students, and the designer and manufacturer might profit economically by its emphasis on the adaptability of different grades and qualities of iron and steel to particular uses. It offers a broad survey supplemented by concise, practical information.

ECONOMICS AS THE BASIS OF LIVING ETHICS. By John G. Murdoch, A.M. Troy, N. Y.: Allen Book and Printing Company. 8vo.; 379 pp.

In adventuring among the highlands and lowlands of socialistic philosophy, Prof. Murdoch was confronted by several fundamental questions. He here attempts to answer some of these by a close investigation of the Marxian doctrine, the ethics of profit and interest, and the economics of Kant. The concrete facts of science govern all his deductions, and his fair and fearless attitude and acute reasoning make the work one to be reckoned with; but just as it is possible to regard body as the basis of mind until one comes to see mind as a mere product of gross matter, so it seems to us that the author's studies tend to involve him in Haeckelian materialism. Economics is beyond doubt the father of Ethics, as John Shakespeare was the father of William; but after all we must eventually deal with Ethics and with William on their own merits.

MODERN CABINET WORK FURNITURE AND FITMENTS. By Percy A. Wells and John Hooper. Philadelphia: J. B. Lippincott Company, 1918. 8vo.; 384 pp.; 1,000 drawings, photographs and original designs.

In this beautiful example of the publisher's art we are given an account of the theory and practice of cabinet work production, with interesting chapters on the growth and progress of design and construction. It is a most comprehensive volume, for it takes the reader, step by step, from the making of joints to the preparation, setting out, and complete construction of innumerable types of furniture and woodwork. The striking illustrations present an admirable blend of the utilitarian and the artistic, and show the changing fashions and methods of the last thirty years. Veneers and veneering; marquetry and inlaying, are incisively treated; there are notes on historic styles, a chapter on special furniture for shops, offices and museums, and another dealing with English, foreign and colonial woods. The exceptionally fine work is rounded out by a glossary of technical terms and a short but choice list of books on historic furniture.

THE BIBLE IN IRON. Or The Pictured Stoves and Stove Plates of the Pennsylvania Germans. By Henry C. Mercer. Doylestown, Pa.: Bucks County Historical Society, Horace M. Mann, Assistant Curator. 8vo.; 174 pp.; 220 plates.

A few years ago there was discovered in Pennsylvania a large number of cast iron plates ornamented with natural objects and human figures in low relief, sacred subjects predominating. These were originally parts of "German" or "Holland" stoves, and they frequently bear dates and inscriptions. Dr. Mercer makes this discovery the basis of his unusual monograph, and much credit is due to the patient research that enabled him to describe so graphically the decorated iron stoves of Colonial America and of Europe. Credit also is due the Bucks County Historical Society under whose auspices the monograph appears, and in whose Colonial Museum most of the plates pictured may be seen. The clear photographic reproductions will delight the eyes of those who have a touch of "the antiquarian in their make-up—and what normal man has not?—and the many curious facts and little unsolved problems the author serves up to us make a particular appeal to lovers of the Colonial.

PRINCIPLES OF HYGIENE. By D. H. Bergey, A.M., M.D., Dr. P.H. Philadelphia and London: W. B. Saunders Company, 1918. 8vo.; 543 pp.; illustrated.

Our continuously progressive knowledge of hygiene makes necessary a frequent revision of texts. This favorably known work carries the revision to 1918, and bears in mind the requirements of medical students, sanitary engineers, physicians, and health officers. Industrial, school, and military and naval hygiene are each given illuminating chapters. Naturally it is a selective, not an exhaustive, treatise. But sound judgment has been used, and general principles and the more important practice have been thoroughly and satisfactorily covered.

THE SLIDE RULE: A PRACTICAL MANUAL. By Charles N. Pickworth. New York: Isaac Pitman & Sons. 8vo.; 133 pp.; illustrated.

This new edition of a work that has long enjoyed public favor should do much to popularize this time-saving mechanical calculator. In its latest form the manual contains descriptions of the latest developments in slide rules; it has a section on screw-cutting gear calculations; and there are numerous other additions, improvements, and revisions.

HOW ANIMALS TALK. And Other Pdeasant Studies of Birds and Beasts. By William J. Long. New York and London: Harper and Brothers, 1919. 8vo.; 302 pp.; illustrated.

Even our nature books have nowadays the taint of sophistication; here is a notable exception whose limpid, charming style reminds one strongly of the simple yet dramatic quality of Fabre; not that it has the breadth and depth of Fabre's interpretations, but that the same sympathy and sincerity shine through the printed page and immediately make the reader a friend. He may not believe that animals communicate by natural telepathy, or that there is such a thing as *chumfo*, the super-sense; but he will believe in the author's belief in these things, and will obediently and gladly follow him along these dim trails. On the side of observation, the author is a woodwise and delightful companion; on the side of deduction he may or may not be ess wise, but is certainly no less delightful; and until science can speak more positively, we may be pardoned for a leaning toward such provocative speculation as is embodied in this charming work.

GENERAL PSYCHOLOGY. By Walter S. Hunter, Professor of Psychology, University of Kansas. Chicago: The University of Chicago Press, 1919. 8vo.; 351 pp.; illustrated.

In "General Psychology" we have an unusually good introductory text-book. Part I is devoted to a practical survey of the fields of animal, individual and applied, abnormal, and racial and social psychology. Here typical problems are brought to the fore. It corresponds to the ground training of the aviator, that gives him the knowledge later utilized in real flights. In Part II., on normal human real flights. In Part II, on normal human Conflicting theories are frankly stated, the evidence for and against them judicially weighed. To the collective opinions of the masters, the author adds individual penetration, clear interpretation, and balanced summaries. The result is to place in the hands of students a most attractive and dependable text.

SHOP WORK. By Herman F. Rusch and Claud Carlton Conway. Indianapolis; Industrial Book and Equipment Company, 1918. 8vo.; 202 pp.; illustrated.

"Shop Work" is the first of a series of school and college vocational-training texts. It deals with joinery, cabinet-making, and carpentry. If the standard set by this work is maintained, the series will find an assured place as an authoritative exposition of principles and technique. The authors of this initial text are well fitted, by long years both of actual practice and of teaching, to put into the hands of teachers and pupils the necessary knowledge as to tools and their handling, bench work, including standard joints, abrasives, etc., and other pertinent topics. The book is strikingly well illustrated by numerous figures and blue prints.

NEW MODERN ILLUSTRATIVE BOOKKEEPING. Advanced Course. By Edward C. Mills. New York: American Book Company, 1919. 8vo.; 324 pp.; illustrated.

In continuation of the introductory course, these lessons familiarize the student with four representative departments of business—retailing, commission, wholesaling, and manufacturing. Also, they carry him beyond the mere keeping of records into the realm of accounting and auditing. Labor-saving plans and devices are made free use of; many new accounts appear, and their relations with the balance sheet and the profit and loss statements are carefully developed. The course is worthy of unqualified recommendation.

SELENIUM CELLS. By Thomas W. Benson. New York: Spon and Chamberlain, 1919. 8vo.; 63 pp.; illustrated.

The selenium cell is the magic wand of the modern magician. Among its present and possible applications may be numbered the transmission of speech over a light-ray, the automatic control of crewless boats, light buoys, and street lamps, the transmissin of photographs over a wire, and certain meteorological and astronomical adaptations. The practical success of some of these applications awaits the perfection of the selenium cell, which offers a rich field for investigation. This helpful treatise considers the various cell types, with special reference to the Fritts system, and gives instructions for the making, testing, maturing and care of the cells.

MILK. By Paul G. Heineman, Ph.D. Philadelphia and London: W. B. Saunders Company, 1919. 8vo.; 684 pp.; illustrated.

If there is one article of diet that demands and deserves a volume to itself, that article is milk. Even this substantial work of Dr. Heineman's does not claim to be exhaustive. A historical outline of churning practice is followed by a chapter on the physiology of lactation; others deal with milk and its relation to infant feeding, the general chemistry of milk, its physical, chemical, and bacteriological examination, adulterations, enzyms, the transmission of toxins, germicidal action, micro-organisms, and infections. Precautionary measures are represented by papers on certification, pasteurization, and the control of milk supplies. The use of milk in butter, cheese, and ice-cream is comprehensively discussed, and even the economic aspect of milk production receives attention. The work is well illustrated, and its bibliographies give access to important sources.

BUSINESS PENMANSHIP. By Edward C. Mills. New York: American Book Company. 77 pp.; illustrated.

There are no flourishes, such as were dear to our grandparents, in Mr. Mills's examples of the good business hand. Neatness, legibility and uniformity pervade his teachings; these are inculcated by valuable practice movements and the analysis of form. The lessons include simple lettering and here alone is shading tolerated. The crisp admonitions and well-graded exercises will prove a distinct aid to acquiring a plain, rapid hand.

ELEMENTARY BIOLOGY. An Introduction to the Science of Life. By Benjamin Charles Gruenberg. New York: Ginn and Company. 8vo.; 528 pp.; illustrated.

Inspired by a desire to make a knowledge of biology contribute to human welfare, this text largely replaces dry and inadequate definition and classification with interesting discussions of behavior, and provides a sound basis for later and more specialized studies. Of the many ingenious diagrams and pictures, a typical example is the plate showing, in parallel cuts, geological strata and the corresponding fossil remains, thus presenting geology and evolution in linked and orderly progression.